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INTRODUCTION.

THE IDEA OF HOLDING AN INDIAN MEDICAL CONGRESS was first mooted by the Editor of the *Indian Medical Gazette*, Dr. W. J. Simpson, in the October issue for 1893, and was cordially taken up by Surgeon-Colonel R. Harvey and some of the leading members of the medical profession. A further impetus was given to the undertaking at a general meeting of the Calcutta Medical Society held in January 1894. The preliminary arrangements were discussed and a general plan sketched out at this meeting. The project assumed its final shape at a general meeting of the profession in Calcutta held early in May; after which time the various Committees set to work to carry out the resolutions formulated at the general meeting. Notwithstanding the difficulties which had to be encountered in a first attempt of this kind in India, the Congress proved successful, beyond the expectations of all concerned. The number of members was 700, and over 200 papers were contributed, the most important of which are published in this Volume of Transactions.

The Reverend Fathers of the St. Xavier's College generously placed their magnificent buildings at the disposal of the Executive Committee. This removed one of the main difficulties, *viz.*, that of obtaining a suitable building, which, while possessing a large hall for general meetings, could also accommodate all the sections, as well as provide space for the exhibition of drugs, surgical and sanitary appliances.

The success of the Congress was materially contributed to by the official patronage of H. E. the Viceroy and H. H. the Lieutenant-Governor of Bengal, and by the action of the Government of India in granting special leave to medical officers in Civil and Military employment, and special travelling concessions on the State Railways. Similar facilities were also afforded by most of the railways and some of the steamer companies in India.

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OF THE

FIRST INDIAN MEDICAL CONGRESS

HELD AT

ST. XAVIER'S COLLEGE, CALCUTTA,

24th to 29th DECEMBER, 1894.

OPENING CEREMONY.

THE FIRST MEDICAL CONGRESS held in India was opened by His Excellency the Viceroy in the splendid hall of St. Xavier's College, kindly lent for the occasion by the Fathers of the Society of Jesus. The immense hall, which has a seating capacity of seven hundred, was filled to overflowing, principally with medical men. The building was gaily decorated for the occasion, and a strip of red broadcloth, with choice crotons, ferns and ornamental plants on either side, led up the grand staircase to the stage at the southern end of the hall on which seats had been placed for His Excellency, the Lieutenant-Governor and other distinguished guests. Long before the appointed hour a very large number of European and Native medical gentlemen arrived, and those who did not prefer to take up advantageous positions on the grand staircase and witness the reception of His Excellency were shown to their places by the Master of Ceremonies and members of the Reception Committee, who wore red or blue rosettes. The excellent acoustic properties of the hall made it almost a matter of indifference where one sat, every word of the several speeches made being heard distinctly in all parts of the house. His Honor the Lieutenant-Governor, who was accompanied by Captain Gaussen, A.-D.-C., arrived about a quarter of an hour before the appointed time and was received by the members of the Reception Committee with Dr. Harvey at their head.

His Honor was conducted to his seat on the stage where there were already seated the Lord Bishop of Calcutta, His Grace Archbishop Goethals, the Hon. Sir Alexander Miller, the Hon. Lieutenant-General Brackenbury, Mr. Ernest Hart, Surgeons Major-General Rice and Bradshaw and the several presidents of sections, Drs. Crombie, Lawrie, Martin, Dimmock, King, Watt, Kanye Lall Dey, McConnell and others. Among those present were Lord Onslow and Lord Elphinstone, H. H. the Maharajah of Durbhanga, H. H. the Maharajah of Mysore, Sir Bhagwant Singhi, Thakur of Gondal (near Kathiawar) who is an honorary M. D.; the very Rev. Fathers Lafont and Naish, the Hon. Dr. Lethbridge, the Hon. Mr. Buckland, the Hon. Mr. Bourdillon, Mr. J. C. Macgregor, Mr. J. G. Ritchie, Mr. S. E. J. Clarke, Mr. H. Rustomji, Babu Juggernath Khunnah and the chaplain to the Lord Bishop.

His Excellency arrived punctually at 11 o'clock, and was received by the members of the Reception Committee, who then formed a procession and marched into the hall two by two, the Viceregal party being conducted to their seats on the dais by Dr. Harvey, the President and the Vice-Presidents taking their seats behind the sofas.

His Excellency, who on rising was very warmly received, then addressed the assembly as follows:—

Mr. President, your Honor, Ladies and Gentlemen,—I have to express my acknowledgments to the Committee for the invitation they have given me to be present on this occasion. I esteem it a privilege that it has fallen to my lot to take part in the opening ceremony of the first Medical Congress in this city, and to extend, as I think I am entitled to do, on behalf of the Government of India, a welcome to the gentlemen who have journeyed, some of them great distances, to attend it. I do not know how it happens that this is the first Indian Medical Conference; but I am sure that I am only speaking the sentiments of all present, when I express the hope that it will have a most successful session. (Cheers.) The claims of the medical profession on our regard call for no exposition. They have been recognised in every country and in every language. No efforts of oratory is requisite to describe the noble profession, whose chief aim is the relief of human suffering, and which offers opportunities to those who follow it for the exercise of some of the highest qualities of which our nature is capable—the prompt decision, the steadiness of purpose, the courageous, or, if need be, the heroic devotion to duty which we sometimes specially claim for man, the intuitive instinct; the quick and ready sympathy, the tender care which we gladly confess finds its highest examples in woman. (Cheers.) And, Mr. President, if I need not dilate on the reasons for the welcome which I offer you, still less is it my duty to describe the purpose for which you have convened this meeting. We shall hear from you, Sir, the necessary explanations of the programme which lies before the Congress. But I should like to be allowed to say why I think the Government cannot be indifferent to your proceedings. I imagine that no one will deny that one of the first duties of any organised Government is to consider how the health of those living within its jurisdiction can be improved, or maintained. (Cheers). As it appears to me, there are two distinct lines on which to approach this question—we may either pursue an enquiry into the nature of the diseases which specially affect the country, or we may turn our attention rather to the habits and mode of life of the people in relation to the prevalence of disease. It is obvious that on both sides great differences will arise according to varying circumstances of time and place. The diseases of the tropics, or, at any rate, the conditions under which we are attacked by them, are not the same as those of the temperate zone. The customs of the East are not those of Europe, and it cannot, I think, but be advantageous that the circumstances which affect us in India should be considered here in India. I do not mean, of course, that no general consideration is now given to these questions. The Government of India and the local Governments have each their officers who are charged with this duty. I have just had placed in my hands the Report for 1893 of the Sanitary Commissioner with the Government of India. It extends, with its appendices, to over 400 folio pages, and contains ample evidence that the subject of Public Health is regarded by the Government as of the first importance. (Cheers.) There are different spheres of action. The Government of India must deal chiefly with general principles; the local Governments and Departments with the manner of the application of these principles in the several localities. But I think it would not be difficult to show that the British Government in India has recognised its responsibilities, and has done what circumstances permitted in this matter. (Cheers.)

I venture to hope that we may, all of us, derive advantage from the proceedings of this Congress. If I understand your object aright, you will have assembled here men who have had the opportunity of studying on the spot the diseases of the people of India, and men who have studied the nature of specific diseases in a manner not compatible with the prosecution of an ordinary practice. Scientific discoveries, like many other discoveries, sometimes come upon us like a thief in the night, suddenly and unexpectedly, but they are more often the outcome of long and patient investigation and the impartial consideration of every point; and we are justified in anticipating advantage to the cause of the scientific investigation of disease from the free interchange of opinion. And if this is true of enquiries into the nature of diseases, it is even more so of the other branch of the subject to which I have referred, that is, the connection of the habits and customs of the people with the subject of Public Health. It is here that the non-professional student of the subject feels more at liberty to intrude, and indeed I cannot deny that occasionally a certain amount of jealousy of scientific sanitation is found amongst those who have to deal practically with the questions which arise. I need not say that I have no sympathy myself with the jealousy (cheers); but I must honestly add that I think it sometimes finds an excuse—I will not say a justification—when theories are ridden too hard. I hold very strongly that in sanitary matters, as in many others, the best way to secure real progress is to begin by forming a public opinion in its favour, and that action in advance of, or in opposition to, public opinion is often apt to retard, rather than promote, the cause we have at heart. (Cheers.)

I am glad to think that there are some signs of the growth of Public Opinion in India on sanitary questions. I have, during the last two months, met a large number of representatives of Municipal Committees and other local bodies, and I find stress is always laid on what they have done, or propose to do, in the matter of water-supply and the like. You may say they represent only the larger places, but are you quite sure that your Public Opinion at home has gone much further? If I do not trespass too long on your time, I am inclined to think that I could give some direct evidence from my own experience bearing on that point; and there is one other incident of my travels that bears on this object which I should like to mention. I was walking one day through a village in a remote district. The ruins that lay about it bore testimony to greater importance in days gone by. There was, I was informed, no pretence of any sanitary arrangement or water-supply, and the people, not unnaturally, suffered severely at certain seasons from fever. But I was struck forcibly by the fact that, in house after house which I passed, the doorway and its surroundings were scrupulously clean. My mind reverted to many an instance where the contrast was not favourable to Western civilisation. (Cheers.)

I know the danger of arguing from a singular instance; but I can only use the opportunities I possess, and all I wish to argue from this little experience of mine is the necessity of tolerance. We hear a good deal of the opposition to, and prejudice against, reform arising from custom. I should like to seek for, and gladly acknowledge, the encouragement which, if my example is worth anything, I believe, can also be found therein. (Cheers.) Some things, of course, we must insist upon, but where there is a fair question of expediency—where the difficulty comes from religious feeling, local customs, financial pressure, or even personal prejudice—I believe there is only one safe rule which I ventured to define to a friend who once asked my advice in a case of the kind as "unlimited patience." (Cheers.) There can be no surer test of the sincerity of a man's belief in his cause than the good-humoured acceptance of any reverse in the struggle on the ground that it can only be temporary.

Mr. President, I think I have said enough to testify not only an official but a personal interest in the work that is before you. (Cheers.) It is an interest which I should feel under any circumstances, but which here, in India, has the additional attraction that it appeals to one apart from all differences of class, or creed, or nationality. (Cheers.) That is the spirit in which the great work identified with the name of Lady Dufferin was undertaken—the task of conveying medical aid to the women of India (cheers); and I am requested by the Lady President of the Fund to take this opportunity of conveying her thanks to the numerous members of the medical profession who have given so much assistance to the various Committees. (Cheers.)

Mr. President, that is the spirit in which I trust sanitary reforms will be presented in India, and in which this Congress will show its readiness to support the efforts of the Government of India. (Loud and continued cheers.)

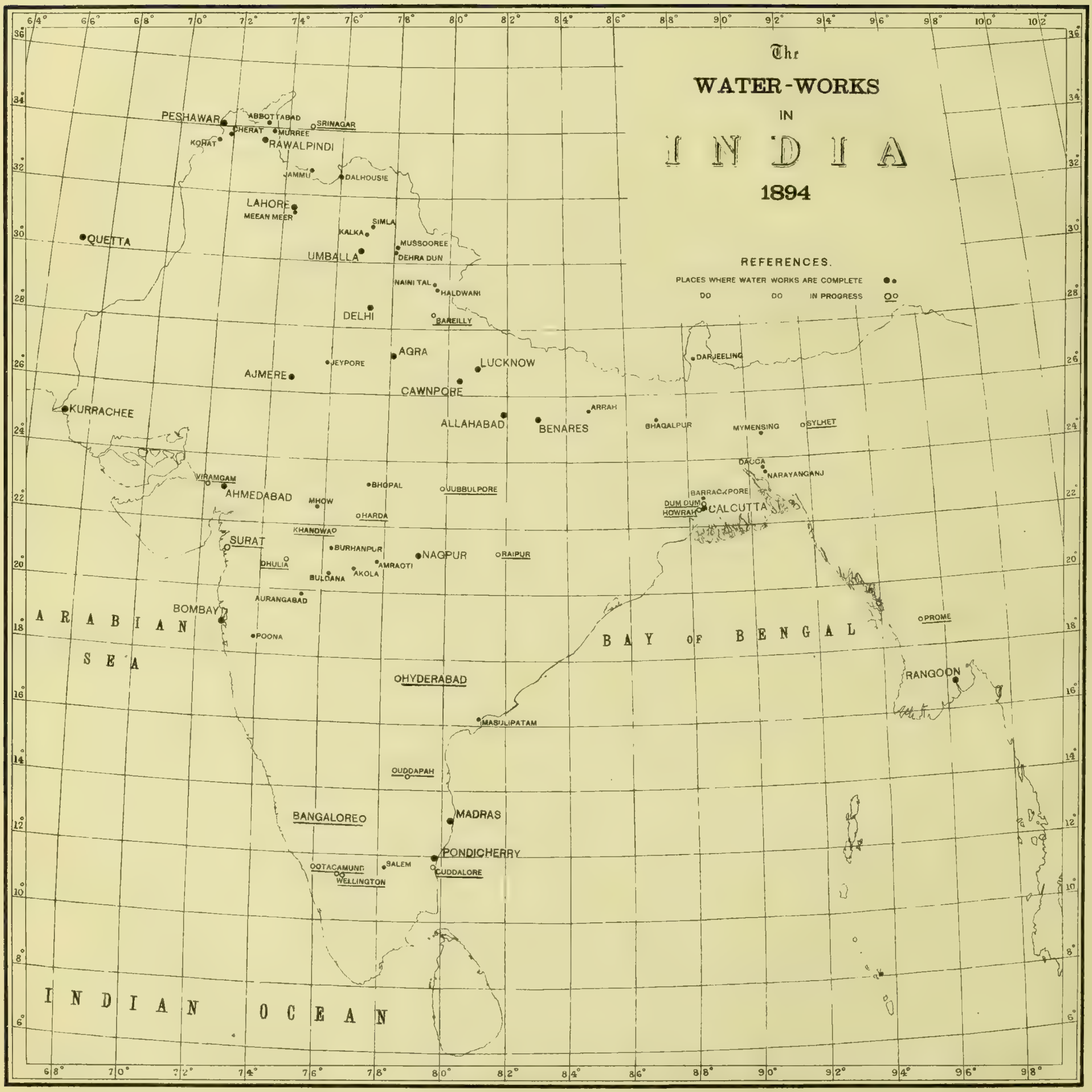
SURGEON-COLONEL R. HARVEY then delivered his Presidential address:—

YOUR Excellency, your Honour, my Lords, Ladies and Gentlemen,—The first duty which devolves upon me is the pleasing one of conveying to your Excellency, on behalf of the Central Committee, and I may say of every member of this Congress, our hearty thanks to your Excellency for the honour you have done us in presiding on this occasion. We take it, and the world will take it, as a proof that the Government of India is anxious and willing to do what in it lies to favour the objects which this Congress has at heart—objects which have no political significance, but which are of consummate interest to the well-being and prosperity of India. The medical profession as such is of no politics, its objects are to battle with disease, to relieve suffering, save life, and promote the health and welfare of the people—ends with which all should sympathize, and towards which all can help. The Congress, by bringing together from all parts of the country all sorts and conditions of medical men, European and Indian, official and non-official, civil and military, private practitioners, medical missionaries, and others, tends to establish a solidarity of interests and aims which is devoutly to be wished for, and to strengthen the influence of the profession by concentrating it in one broad current. It brings men into close and kindly personal relations, cements old, and lays the foundations of new friendships, enables us to compare experiences, and puts on permanent record much valuable material which is now lost for want of a chronicler. When the idea of a Congress was first started, there was considerable doubt as to whether India was sufficiently advanced to be able to make it a success, and many difficulties were pointed to by cautious men. The Committee and the Secretaries, however, accepting the Napoleonic definition of a difficulty as something to be overcome, and feeling sure that success was attainable, proceeded to attain it. *Si monumentum requiris, circumspice.* You have but to look at this meeting to see the monument of their success, and the programme of work to be got through is such that I greatly fear many papers will have to be taken as read. Our total membership is 780; a very large number of papers have been sent in, many of them of the very highest professional and public interest, involving discussions of supreme importance both to the public health and to the public pocket. The success, of which we are now assured, is due in part to the exertions of the Central and Executive Committees, in part to the unwearied exertions of the General Secretaries, in part to the kindness and goodwill of the Government in granting facilities for attendance, and to the splendid hospitality of the Reverend Fathers who have placed this great College at our disposal. It is, however, mainly and above all due to the fact that the profession has been true to itself and to its own best traditions. Nothing but good can come from such a meeting, and I trust that this the first Indian Medical Congress may be followed every three or four years by many others to the advantage of the profession and of the country. I have, on the part of the Central Committee, to extend a warm welcome to the delegates who have come to us from other countries. They are all too few, but the exigencies of medical work in the busy season at home has kept many away, and the length and supposed difficulties of the voyage have detained others.

I will now try to indicate in the briefest way what modern medicine has done, is doing, and may hope in the future to do for India. The subject is so vast that it can be given in outline and no more, a mere scene-painter's sketch, not a finished picture. By modern medicine I, of course, mean the science introduced from Europe by the earliest medical officers of the H. E. I. C. From the small beginnings made by them as developed by natural evolution, our system of hospitals and dispensaries, sanitation, vaccination, medical education as they exist to-day, and from which we hope that a further development may take us in time to things unattempted yet.

It is a curious fact that it was in gratitude to a doctor envoy for professional services that the first firman was granted to the Company by the Emperor Jehangir. In the earlier days of the Company, and, in fact, up to the evil times of 1857, and to some extent even yet, we find medical officers in the most incongruous and unexpected positions and places—Residents and Envoys at foreign Courts, Commissioners and Deputy Commissioners, Superintendents of Gunpowder Factories, Postmasters-General, heads of such departments as the Telegraph, Masters of Mints, and so on. This, I take, was due in great measure to the fact that in the earlier days both civilians and military officers came out so young that they were beaten in the advantages education gives by the older and more scientifically trained medical officers. The medical science of the day we should now look upon as very primitive, but it was the best that was to be had, and did yeoman's service to the Company and the people. As the red boundary line of England's influence extended, dispensaries and hospitals sprang up in all the large cities, and brought relief to many, specially surgical relief. The idea of preventive medicine had not yet been born, even in England, so that no sanitary service was attempted. Vaccination was, however, started within two years of its discovery by Jenner, and a beginning was made with medical education. From a very early time, Native Doctors, as they were then called, were trained at the local dispensaries, beginning as apprentices, or even as hospital coolies, picking up what they could at the bedside, aided by informal teaching from the Civil Surgeon. The results, strange as it may seem, were sometimes surprisingly good. I have seen lithotomy and cataract operations ideally perfect in *technique*, finish and result performed by a man who had never attended a medical school and knew next to nothing of anatomy. As a rule, however, the results were not satisfactory, and an enormous advance was made when, in 1822, a vernacular medical school was started in Calcutta. Systematic medical education really began, however, with the opening of the Medical College of Bengal in 1834, followed by that at Madras in 1835, and at Bombay in 1845. In all those the instruction was in English. The Vernacular Medical School in Calcutta was followed by one at Haiderabad founded in 1846, another at Agra in 1855, and one at Lahore in 1860. When I came to India in 1865 these were the only schools.

I tried to get for this address a statistical statement shewing the chief medical and surgical results obtained throughout India in 1865. The first year for which complete statistics are available is, however, 1877. If



The WATER-WORKS IN INDIA 1894

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Reg. No. 18, Indian Medical Congress.—Feb. 95—500.

Litho., S. I. O., Calcutta.

the progress between 1865 and 1877 was at the same ratio as between 1877 and 1893, we should have to halve the figures of 1877 to arrive at those of 1865. In 1877, then, 6,142,070 patients were treated in 1,147 hospitals and dispensaries; 4,633,105 vaccinations were performed; 2,682 operations for stone and 2,372 for cataract. These were great results and reflect the utmost credit on the officers who attained them; but they were nothing in relation to the population and true needs of the country. Small tentative efforts had been made to introduce sanitary improvement—I am now speaking of 1865—but systematic sanitation, as we know it, had not begun. The Sanitary Department, though its formation was under consideration, had not been constituted, and the deathrate of the European troops had, from the beginning of the century, reached the appalling annual average of 69 per mille. A Royal Commission sitting in 1864 ventured to express a hope that the introduction of scientific sanitation might reduce this to 20 per mille, and the creation of the Sanitary Department as a result of their recommendations may be taken as a boundary line dividing the past from the present of medical work in India.

My period of service, now close on 30 years, coincides with this. It has been marked by enormous progress in all directions. Medical Colleges, in which a complete education is given in English, have been opened at Lahore, Allahabad, Tanjore, and Nellore, and affiliated to the Universities. At Haiderabad the classes have been taught in English since 1882. Additional Vernacular Medical Schools for the education of Civil Hospital Assistants and Civil Medical Practitioners are now working at Sealdah, Patna, Dacca, Katak, Poona and Ahmedabad.

The medical education of women has also been recently introduced, and girls are now trained for the purposes of the Dufferin Fund at most of the medical schools. The number of hospitals and dispensaries open last year was 2,025, in which were treated 16,973,468 patients, increases of 76 and 176 per cent. over 1877. There were 4,476 operations for stone, 20,279 for cataract. Vaccination has been enormously extended and put on a much more systematic footing; 7,502,024 operations were done—an increase of 62 per cent. These figures indicate great activity and afford ground for congratulation, yet, compared with the wants of the country, indicate that they still touch but the fringe of the population. In Bengal, for instance, only one-fifteenth of the people are within five miles of a dispensary, and a considerable percentage of the children born escape vaccination, so that bad epidemics of small-pox are still possible. Of recent years an entirely new development has taken place in the organisation of special hospitals for women officered by medical women, under the fostering care of the noble Lady Dufferin, whose name like Milton's should resound for ages among the zenanas of India. Still in its infancy it is doing enormous good to a class whose needs are of the sorest, and it is, I believe, destined to flourish and increase till every important town in India has its Dufferin Hospital side by side with its hospital for males.

Sanitary progress, however, is the chief feature of the last 30 years, and more especially of the last decade. I have told you how the deathrate of British soldiers up to 1857 averaged 69 per mille, and that the Sanitary Commission ventured to hope it might be reduced to 20. This estimate was too modest, for since 1882 it has never exceeded 15, except in 1889 when it was 16·6, less than a quarter of the previous rate. The reduction has been effected by hygienic reforms of all kinds, but especially by the gradual improvement of the water-supply in cantonments, first by cleaning and protecting wells and tanks and setting them aside for drinking purposes only, a plan which has been followed for many years; and of recent years by scientifically devised water-works provided with all the latest improvements. A glance at two maps on the wall will give a better idea than any words can of the great recent advances in this direction. The first representing the India of 1865 is like the Chart of the Snark-hunters "a perfect and absolute blank." The second shows the cities, towns and cantonments now properly supplied, or in course of being supplied, with pure water. In those with dotted lines the works are in hand, but not yet in operation. The Cawnpore works are complete in the town, but have not yet been extended to the cantonment. The Marri water scheme supplies Dunga Gali, Kyra Gali, Bawan, Kuldanna, Clifden, Gharial, and Thopa, as well as the Marri Bazar, cantonment and civil station. It cost Rs. 7,20,000. The whole of the troops in the hills near Marri, numbering some 5,000, are thus supplied with pure water. Many additional schemes are under consideration.

It has long been the fashion to poke fun at the Sanitary Department, to denounce it as a sham and a pretence, producing reports which lead to nothing—*Vox et prœterea nihil*—and sanitary officers themselves have sometimes felt that much of their labour was of the Sysiphean sort in the absence of any means to enforce and carry out their recommendations. The map seems to me to point to encouragement instead of despair. Even in England modern sanitation is a thing of the present century—mainly of the last half century—finality has not been reached, and popular ignorance and prejudice and vested interests still block many possible improvements. In India where *stare super vias antiquas*, what was good enough for our fathers is good enough for us, is a sentiment deep rooted in the hearts of the people and is almost a part of their religion, it is small wonder that the progress has been slow. Still the progress is there, and in India, as elsewhere, tends to acquire continually increasing force and volume as it proceeds.

Municipal Acts containing provision *inter alia* for sanitary measures, Village Sanitation Acts specially designed *ad hoc*, have been embodied in our laws, and though mainly permissive can be extended by notification to such places as seem sufficiently advanced to accept them.

Sanitary Boards on which is a Sanitary Engineer are now established in most provinces. Various schemes are on foot for extension of water-works, drainage and other improvements. The importance of sanitary measures is now much more fully recognised than it was even a few years ago; so are the obligations of Governments to deal with preventible diseases ; the latter fact finding practical expression in the greatly improved arrangements for the regulation of the great religious gatherings at Hardwar and elsewhere, the supervision of pilgrim traffic, and so on. To cynics and pessimists who object that what has been done is as nothing to what remains to do, I can only say with Tennyson, "Wait, my faith is large in time." Sanitation is in the air, and my successor in this chair 30 years hence will, I venture to think, be able to announce progress still greater than has been made since 1865.

Sam Slick has warned us not to prophesy unless we know. I will not prophesy, but will now try to indicate a little more fully in what directions progress is likely and desirable, the difficulties in the way, and the means of overcoming them. No one is more thoroughly aware than I how little the great deal that has been done is, compared with what is left to do, and no one can recognise more fully the difficulties in the way of affecting such a general reform as shall satisfy Europe When asked what India wants from medical and sanitary science, I am tempted to use the words of the ragged urchin in *Punch* who replied to a similar question, "I thinks I wants most everythink." Let me enumerate the needs, first medical, then sanitary. We will take the question as to the means of providing for them later. The first and greatest is, like Cerberus, three-headed. To bring the advantages of modern medicine within reach of all we require a great extension of hospitals and dispensaries, officered by a class of locally-trained practitioners of higher professional attainments than the average of those educated at existing schools. This in turn involves improved facilities for teaching by bringing the schools up to date in method and equipment, raising the educational standards and improving the position of the graduates and licentiates. I have mentioned that only one-fifteenth of the population of Bengal is within a reasonable distance of a dispensary. Other provinces are in advance of Bengal, and the N.-W. P. do not intend to be content till they have a dispensary within five miles of every one. If the principle is to be generally applied the *personnel* of the Medical Department will have to be largely increased, and will even then have to be supplemented by the labours of a vast number of independent practitioners. I consider however that till we have an improvement in the standard of medical education, any great immediate increase in the number of dispensaries is not desirable. Itinerant dispensaries, such as have been provided in the Native State of Gondal at the trifling annual cost of Rs. 1,300 each, might be helpful for a time, but are at best a makeshift. As an old teacher and examiner I think that the medical education already given is as regards the great colleges which teach in English marvellously good, and that many of our native graduates are fit to hold their own with men educated in any land. The results achieved in some instances by the vernacular schools are also surprising and have greatly improved of recent years. Neither English nor vernacular schools, however, are as efficient as they should be. The Medical College of Calcutta, the parent of all subsequent medical schools, is most miserably and inadequately housed. It has but two poor theatres in which lecture has to succeed lecture without intermission, so that the professors have neither the time nor the opportunity to prepare for their demonstrations, and the rooms are poisoned by the mephitic air of a succession of audiences. There is no room for the professors,—not even a lavatory in which to wash their hands. Continuous efforts have been made to keep the teaching equipment in line with modern progress, and with fair success, but the laboratories, dissecting-room, anatomical and other departments are all cramped for room, and so damp and dark and ill-arranged that effective teaching is very difficult. It is far behind the schools in Bombay, Madras, and Lahore, and in some respects even behind the vernacular school at Agra. Most of the vernacular schools are equipped on a scale so modest that the wonder is they can attain such results as they do, which must be ascribed to the diligence and good-will of both teachers and students. Recommendations have recently been made which, if accepted by Government, will give improved facilities for teaching, and will improve also the position and prospects of such of the licentiates as enter the service of Government. Though still capable of improvements, the success in medical education in India has been phenomenal, and for a time the supply of practitioners has almost outrun the demand. Competition is severe and opportunities of attaining distinction limited, since Government naturally appoints its own servants to its own hospitals and teacherships. The services are open to all, but admission to the commissioned ranks involves a sojourn in England with a severe competitive examination at the end of it, and the local service, while also limited, has so few real prizes that it is not in great request. An outlet which would meet the natural aspirations of a most deserving class of men is greatly needed, and will, I believe, be found as the number of hospitals increases and the Health Department is strengthened. The bulk of practitioners must, however, still look to private practice, and as education spreads the demand for their services is constantly increasing. The Government in India does more than any Government in the world to provide medical aid for its subjects, but no Government can give employment to all comers. The local profession, if I may venture to say so, wants a little more self-help and self-reliance. The School of Medicine recently established in Calcutta independent of Government aid is a step in the right direction, and when hospitals are built and maintained in India, as in England, by voluntary contributions, the contributors will naturally elect their own officers. They are empowered to do so under existing regulations, and 139 of the dispensaries of Bengal are at present officered by medical men elected by the committees. The difficulties and limitations of private practitioners have my warmest sympathy. I have always done, and will always do, my best to help them; but, so long as the great hospitals and medical schools are maintained by Government, it is reasonable that they should be officered by Government servants, and so long as Government continue to get the best men they can by open competition of the severest kind, I fail to see that there is any valid reason for complaints. As Shakespeare says:—

> The remedies oft in ourselves do lie
> Which we ascribe to heaven,

and the remedy here lies in private enterprise uncontrolled by Government; though in all probability, aided and fostered by Government, which is always ready to help those who help themselves. A new hospital is to be built in Calcutta by Government. I have recommended that on certain conditions it shall be governed by trustees and officered by non-officials, but have distinctly said I do not recommend it if the extra cost involved is to fall on the Government. That extra cost should be raised without difficulty if there is any real desire for the new departure. We meet you more than half way, do you for your own selves the rest.

Another need felt greatly by the profession is that of some such Act as the Medical Acts of England, by which properly educated and duly qualified men may be distinguished from the host of quacks, charlatans and impostors who everywhere abound. It is not to be expected that the State can put down, or try to put down, quackery, but it would be something to be able to tell regular practitioners from the predatory free-lances, and if, in addition to a register, some body analogous to the Medical Council of England were appointed, another advantage would be gained, and it would be possible to elevate and improve the condition of the profession by purging it of those members—few and yet still far more common than they ought to be—who disgrace themselves and help to degrade medicine by public advertisements, the issue of obscene catalogues and other objectionable practices.

The elimination of such persons would raise the tone of the whole profession and improve our ethical standards, which are much too low. We want to see less of the trade and more of the scientific element, and while it is no doubt true, in spite of Talleyrand, that a man must live, he must not *proper vitam vivendi perdere causas*, for the sake of life give up all that makes life worth living. Fine phrases as to the dignity of our noble profession, the unity of its interests, the catholicity of its aims are mere pickings from the waste-basket of words in the mouth of a man who will steal his neighbour's patient and blast his good name with a sneer. The too credulous public whom every sophister can lime are mainly to blame for the constant changes of medical attendants so common in India, but if medical men were less ready to humour them, and more apt to point out the foolishness of what Lincoln called swapping horses in mid stream, it would be good for both patient and practitioner.

Another great and crying need both for the profession and the public is the extension to India of those modern discoveries which are so fruitful for good in Europe, and which have such splendid potentialities of future development. It is not creditable that India, whose crowded millions are as interested as any in the solution of the problems of disease, and the provision of remedies, should be doing nothing to bring about such desirable results. It is not to the credit of England that when the plague breaks out in a Crown Colony, she should be dependent on a country like Japan for a demonstration of the cause of it. It has often been a reproach to Indian medical men that with all their vast opportunities they have done little for pathology. The charge is in the main true, though brilliant exceptions might be mentioned, but the explanation is not far to seek. No man can serve two masters, and officers liable to transfer from one end of India to another at the shortest notice, with hospital and private work filling their time and causing constant interruptions, cannot, if they would, give the close attention which is necessary to successful pathological work. Modern pathology, including bacteriology, demands the whole time of its votaries, and laboratories filled with costly instruments and appliances. There is work in abundance for many observers, but the scheme of the Government Medical Department hardly contemplates such, and here, too, we must look mainly to private enterprise, though Government may well be asked to aid. I have long been pleading for a thorough scientific investigation of Indian fevers. Years ago I recorded my opinion that one, or possibly more, specific fevers are mixed up together with those recognised in the official nomenclature. The working out of this point is of supreme importance to India, where some 75 per cent. of the recorded deaths are ascribed to fever, that it cannot be done without special research. Diphtheria is a very fatal and destructive disease. A new mode of treatment, which has already been tried on an extensive scale, promises to reduce the mortality by one half. Yet this treatment cannot be made available to the people of India until facilities for carrying it out are provided. Persons bitten by rabid animals have to go to Paris for treatment. All these needs will be met, and India take her proper place among those countries which are trying to advance science for the benefit alike of men and animals, when the Pasteur Institute of India is established. That institute we mean to have, and to have mainly as the result of private enterprise. Our success has been so far hampered by the well-meaning efforts of kind-hearted persons who have let their imaginations run away with them. This is not the place to discuss the question of vivisection. I am about to deal with it elsewhere and hope to be able to convince all but a few irreconcilables that the Institute is entirely justifiable, and that sensitive and humane men may freely subscribe to it, as I again ask them to do. I must be allowed, however, to protest publicly against baseless charges of abominable cruelty levied against the medical profession as a body. I claim, and I believe public opinion will support me, that no profession is more full of sympathy for suffering or more prompt and eager to relieve it.

It is these same irreconcilables or others of a like kidney who, ignoring the alcoholic beam in the eye of England, wish to remove the opium mote from the eye of India, regardless of the wishes and interests of her people. It is they, too, who prevent us from preventing preventible disease, and thus make themselves individually instrumental in causing the conveyance of a horrible malady to numbers of innocent women and children, and in allowing the admissions from these diseases to rise from 15,006 in 1883 to 32,663, or 466 per mille per annum, in 1893—figures which represent three regiments permanently in hospital and useless to the taxpayer. It is time that the commonsense of mankind should refuse to be dictated to by a minority of imperfectly informed and unscientific persons whose zeal is in inverse ratio to their knowledge.

These then are the chief medical, I now pass on to the sanitary, needs of India, and I may begin by admitting that in spite of all that has been done, Indian sanitation, even in the large towns, is still in its infancy; while in many of the smaller towns it has not yet been born, and in most villages not so much as thought of in a practical sense. Drainage, conservancy, water-supply, ventilation are all neglected; vaccination submitted to rather than welcomed, suggestions for improvement fall upon deaf ears, and there is neither the motive nor the money to carry them out. The solution of the problem seems hopeless, yet it must be found. The Governments of Europe are calling on India to attack cholera in its home, practical sanitarians like Miss Nightingale suggest plans for doing so, exhortations, remonstrations, protests against the Government of India are not wanting, and it is lectured like a froward child for its shortcomings and supposed supineness. I tell you gentlemen, as His Excellency the Viceroy has told us to-day, that the Government of India is willing and anxious to do what it can. It recognizes, however, as all reflective people must recognise, the enormous difficulties in the way, not financial difficulties only, though these are many and great, but chiefly, and before all, difficulties due to the ignorance, prejudices, callousness, and superstitions of the people. No Government, and least of all an alien Government, can ignore these. You can no more make people clean than you can make them moral by acts and regulations, and no laws or regulations are likely to be successful unless the educated opinion of the country is in their favour. People who have once learned the blessings and comforts of cleanliness, leaven those below them, each step in improved sanitation leads to others, progress widens slowly down from precedent to precedent, converts increase, knowledge spreads, and a sufficient public opinion is at last created to sanction and accept the reform. This process has had to be passed through in England, and has been an uphill task as all sanitarians can testify. In India the conservative habits of the people, the binding force of caste, of use and wont, of family traditions and the example of their fathers make the work of educating them even harder still, while the general poverty of the country, as measured in coin, makes it very difficult to induce them to consent to measures which must involve fresh taxation. The results of sanitary work are measured chiefly by vital statistics, but people have to be fairly educated before they can understand what statistics mean, and require the imaginative faculty to realize them when understood. A deathrate reduced from 50 to 20 is accepted with complacency, but even educated people have to think it over before they realize that in India such figures would mean the saving of 8,400,000 lives a year, and some 50,000,000 cases of avoidable illness. There are no such wastrels as sickness and death. Once get people to appreciate this and they will be more ready to pay for preventive measures. At present they see that the cost is present and immediate, the results remote, uncertain and indirect. "All men think all men mortal but themselves," and the individual sees no reason why he should not live as long as another. In dealing with such opinions and prejudices the Government may well be cautious, but the idea once prevalent in Europe that it was also careless is now, I hope, well exploded. The authorities know the evils and are willing to apply such remedies as may be possible. Putting aside, however, the difficulties already mentioned, supposing the people educated to the pitch of desiring the improvements which they now deprecate, we are at once brought up by the financial difficulty. Praise is constantly lavished on England on account of what she does for sanitation, and the praise is thoroughly deserved. But England is relatively a small country and enormously rich. India is, on the other hand, one of the largest, most populous and poorest of countries. The standard of comfort, as measured in terms of European economics, is low, though, as the wants are few, it is really higher than it seems. The population of Great Britain and Ireland is under 38, that of India over 222 millions, excluding nearly 67 millions in Native States. The revenue of England is in round numbers and excluding local items £91,000,000 in pounds sterling, that of India excluding railways 64 millions in tens of rupees, and so terribly has that poor coin, like Lucifer, fallen from his high estate, that, in spite of equalling or exceeding, as was the case 30 years ago, the pound sterling, ten rupees, is at present exchange only worth 11 shillings. The income of India is thus represented in sterling by £36,000,000. The revenue per head in England works out £2-8, in India three shillings and threepence, or in the proportion of fourteen to one. Sanitary works also are probably more expensive in India than in England, for though labour is cheaper and engineering difficulties less, the trained staff is much more expensive, and much of the material has to be imported. It is said that England spends nine millions a year on sanitary works, and though I cannot find any definite authority for the statement, or any precise figures, this is probably an approximation to the truth. The expenditure has, moreover, been going on for years and the great works already executed represent enormous capital, the only direct interest of which is the improvement in the public health and consequent decrease of sickness and mortality. In India this capital has yet to be invested, and as her needs are greater, her expenditure should be greater than that of England. Do any of you realize what this means? It means an expenditure of nearly £53,000,000 a year to bring us to the English level—much more than the whole revenue of the country. It is clear, therefore, that, even if the people were prepared for it, financial reasons alone make it impossible at present for the Government to deal adequately with general sanitary problems out of the public funds, or to "enforce sanitation" as they are airily requested to by irresponsible sanitarians ignorant of the magnitude of their demand.

The tendency of opinion in India to look on Government as a sort of Celestial Jack-in-the-Box, ever ready to spring to the rescue when affairs go wrong, is a very strong one, but the Government cannot work miracles or make two and two equal to 53.

The people then are unwilling, the Government unable, to provide means for efficient sanitation *per saltum*. Are we then to conclude that the problem is insoluble, a conundrum to be given up, and that we should sit down with folded hands and do nothing? I have many times heard the note of despair. I know that many men consider our efforts to be hopeless, and our views the dreams of visionaries, blind to facts and deaf to the voice of experience. I confess, gentlemen, that I take a more cheerful view than this, and while fully recognizing the difficulties I have pointed out, refuse to impale myself on either horn of the dilemma. I hold that it becomes no man to brook despair, that by sitting still in face of a recognized evil instead of contending against it we make ourselves responsible for it, and that it is only by "pegging away" that progress is possible. Our friends, the Fathers, will tell you that a "counsel of perfection" is the highest ideal of excellence, to be kept in view and striven for, although hardly to be attained by frail mortals. A model India with all the latest sanitary improvement is such an ideal. The man of little faith says: "It is high, you cannot attain unto it." We can at least seek after it, and toiling hard against the stream of prejudice and difficulty, see distant slopes of a sanitary Eden gleaming in the distance. As George Herbert says—

> Who aimeth at the sky
> Shoots higher far than he that means a tree.

The map on the wall, the facts and figures that I have quoted to you, showing the progress that has been made, are to me full of significance and hope; and I now pass on to indicate the means by which in process of time our sanitary reformation is to be effected. There is "much virtue in" in process of time, and if one thing is needful it is time, you must hasten slowly, remembering that the habits and usages of centuries cannot be changed in a day, but can only be gradually modified by a slow progress of education. That progress is going on. The elements of hygiene are taught in primary schools, and no doubt produce impressions on some youthful minds. If the books, which are somewhat dry and technical, could be made more interesting it would be a gain. Societies, like the Calcutta Health Society, by tracts and lectures help the spread of knowledge, and I understand that my friend, Mr. Hart, whom we are glad to welcome here to-day, has brought out a scheme for establishing branches of the Health Society of England in all important towns. Mockers will say: "This is all talk, we want action." I have shown, however, that action is impossible, unless we carry the people with us, and much palaver is required to bring them on. As one of my counsels of perfection I see a great hygienic service with a skilled Health Officer in every district, pointing out to a people anxious to follow his advice their chief sanitary wants, controlling and inspecting vaccination, supervising water-supply, conservancy, drainage, checking vital statistics, and regulating, under the advice and direction of the Sanitary Commissioner, the public health of the district. These multifarious functions are at present supposed to be performed by the Civil Surgeon who, in addition to his ordinary medical duties, is also responsible for the whole medico-legal work of the district, for the management as well as medical charge of the jail, and for the inspection of outlying dispensaries. I know no more hard-working and devoted body of men than Civil Surgeons. They accomplish the wonderful feat of serving not two but three or four masters, but they have not yet attained the accomplishment of Sir Boyle Roche's bird, and cannot be in two places at once. The three main elements of successful sanitary and vaccination work are inspection and inspection and inspection. Without this it sinks into a sham which may make a fine show on paper, but will not bear stress or strain. A Civil Surgeon's inspections, as a rule, consist of a drive along a road to some branch dispensary, and there looking at what vaccinated children can be brought to him. He has no camp equipage permitting him to travel in the interior of his district, and if he had, the Collector would probably, and the Inspector-General of Jails certainly, object to his leaving the station for more than three or four days at a time. The necessity for special Health Officers then is plain. Where are they to come from, and how are they to be paid? I cannot shirk the problem, and must at least suggest some solution of it. The magnitude of the difficulties caused by the enormous size and population of the country has been pointed out; it is in the very magnitude of the population that I see grounds for hope. One anna, a trifle more than three farthings, per head of the population paid to a special sanitary fund would produce in round numbers 14 millions of rupees, and would not only supply a Health Officer for every district in India, but would leave a very large balance available for sanitary works. When the people get to see the real value of sanitation this anna and much more should be easily forthcoming, and the Health Officers themselves would be potent factors in the spread of sanitary enlightenment. The creation of health officerships would afford a career to many of our best graduates. Their pay would be provided by the sanitary fund, contributed by the people interested. Government would, in a general way, control and direct, deciding on questions of priority, and so on, but the scheme would be worked mainly on local lines, by an amalgamation of village unions, contributing *pro rata* to a common fund. Self-help would have free scope and self-government be made more possible and real. To me it is a marvel that an educated community should cry to Government for everything as a baby cries to its mother. Sanitary improvements, the building and maintenance of hospitals are not in other countries paid for by Government. I have proved that the Government of India cannot supply them, though it does more for the medical needs of its people than any other Government I know. It is to municipal taxation levied for their individual and collective benefit by the people who pay it that we must mainly look, supported and enhanced by private benevolence. A good deal has already been given in this way, but it has been a mere drop in the ocean that is wanted. I commend the needs of the sick poor to all rich and charitable men, of whom there are many in India. I could dispose of many lakhs to great advantage if they were placed at my disposal. We want ten for a new Medical College alone, and I am sure His Honour would be greatly obliged if anyone would save him from the difficult task of finding it from the State coffers.

Such, gentlemen, are the sanitary needs of India, the aspirations of her sanitarians. If I have seemed to give to airy nothings a local habitation which has as yet no objective existence, I can only repeat my belief that time will turn them to shape, and that, by slow degrees no doubt but still advancing, the progress of the last few years will continue and increase. I would ask all the members of this Congress to be of good courage. Everyone of us can do something to promote improvement, and we should never relax our efforts in the fight against darkness and ignorance, and all the suffering which they bring. Beaten we may be for a time, but let us—

> Combating because we ought to combat
> Rejoicing fight, and still rejoicing fall,

sure that victory will come, if not to us to our successors.

His Honour the Lieutenant-Governor of Bengal, in proposing a vote of thanks to Dr. Harvey, said:—

Your Excellency, Ladies, and Gentlemen,—I thank you for the honour which has been done me by asking me to perform the pleasing duty of presenting you thanks for the address which the President has delivered on this occasion. I am sure that I shall be supported by the whole of this assembly in proposing this resolution. There are three classes from whom the thanks on this occasion are due,—these are the medical profession, the Government officials, and the public at large. On behalf of the medical profession, my friend, Dr. Gallay, who represents

French medicine in India, will speak on that part of the subject. On the part of Government officials, I can do no better than subscribe to the remarks which have fallen from His Excellency the Viceroy as to the great importance which the Government attaches to everything which may conduce to the spread and improvement of medical knowledge, and to the difficulties which retard the Government in carrying out this earnest wish, and I especially thank Dr. Harvey for the extent and fulness with which he has dwelt on this subject, and the way in which he has demonstrated how serious this retarding is, and how important it is that every one should try to do what they can, and as His Excellency said, Government will overcome them. Dr. Harvey referred to the subject of inoculation against rabies which has been before us within the last year, and which is of signal interest to those persons who are somewhat in advance of their fellows, and who are hindered and retarded by the objections of ignorant persons who disbelieve the properties of the remedy suggested. Another subject which has been a good deal in the mind of Government is that regarding cholera among Mecca pilgrims. Our distinguished visitor, Mr. Hart, delivered a lecture on this subject on Saturday, and showed the value of what Dr. Harvey said about the importance of carrying the mind of the public with us. Any attempt that we may make to put down the evils which attend the pilgrimage to Mecca, in the course of which so many of our fellow-subjects in this country suffer seriously and perish in the way, is to be welcomed. They start from this place in a state of disease and in a state of poverty, by reason of which they are unable to carry out the journey properly and safely. To relieve this, there are excellent philanthropic people who would desire to do much, but it is absolutely impossible to do anything unless we can carry the people with us, unless we can carry the feelings and wishes of the people along with us. No doubt that Mahomedans are the persons from whom the pilgrims are drawn, and I thank Mr. Hart for my own part and on behalf of Government for the trouble he has taken in drawing together the members of the Mahomedan community, whose leading representatives met him a few days ago to share his views and to see with his eyes. Lastly, on the part of the public—not of an incredulous public of the kind as Dr. Harvey has just said, but of an intelligent and far-sighted public who is represented here, the public of India who will read the report of this proceeding, and the public who are interested in the matters which are to be discussed in this Congress, and in the evidence of the knowledge as to the history and progress of disease, I beg to present the thanks of the public for all that can be done, and will be done, by this Congress, to spread abroad knowledge in medical matters, and to assist the medical profession in increasing the great measure of good which they have long done to humanity at the time of suffering and illness. I am sure that the thanks to the President for his address will be received with great heartiness by the whole assembly.

Dr. Gallay, Delegate of the French Government, in seconding the vote of thanks, said—Excellence, Mesdames et Messieurs,—Le Comité organisateur du Congrés m'a confié le perilleux honneur de venir appuyer devant vous la proposition de remerciements que Sir Charles Elliott vient de formuler en faveur de notre président le Surgeon-Colonel Harvey. Sur un territoire bien petit en comparaison de l'immense Empire Britannique Indien, et en nombre bien faible a côté d'une aussi nombreuse assemblée de médecins, les Médecins Français dans l'Inde luttent pour la même cause que vous. Ils cherchent à initier les natifs aux méthodes scientifiques Européennes, à les ammener a utiliser nos practiques Thérapeutiques et Chirurigicales, à les encourager pour le plus grand bien de leur existence, a soummettre leur habitations aux grandes lois de l'hygiène publique. Ils rencontrent dans l'execution de cette tâche les mêmes difficultés que vous. Ils se heurtent à des traditions séculaires qu'ils doivent respecter sous peine de repousser et de s'aliener des esprits qu'ils cherchent au contraire à attirer et à seduire. Vous le voyez, Médicins Anglais et Français ; Dans l'Inde rous n'avons que des idées communes. C'est ce qu'a compris son Excellence le Gouverneur des Etablissements Français quand il m'a fait l'honneur de me désigner pour venir le representer au milieu de vous, et je dois en son nom remercier publiquement le Comité et son President de la Convocation qu'ils ont bien voulu envoyer aux Médecins Français de l'Inde au moment de l'organisation de cette réunion. Pour moi, personnellement, je dois les remercier aussi de l'accueil qu'ils m'ont réservé. Ils m'ont reçu comme un membre de la famille médicale Indienne, comme un enfant gâté de la famille puis qu'ils m'ont ménagé l'honneur de porter la parole en votre nom à tous. Maintenant j'ai la conviction profonde, et vous l'avez comme moi, j'en suis sûr, que de la rencontre de tout d'esprits scientifiques: de l'échange de leur idées, doit dater pour les sciences médicales dans l'Inde, une erre de progrés considerable. Vous croyez aussi comme moi que l'honneur de ce progrés doit revenir à celui qui a accepté toute la peine pour réunir cette assemblée. Aussi suis-je sûr que tous du fond du cœur vous répéterez avec moi les paroles qu'en votre nom j'adresse pour finir au Président du Congrés—Surgeon-Colonel Harvey in the name of all the Surgeons and Medical Officers in India—I thank you!

Dr. Harvey tendered his thanks for the vote of thanks.

Surgeon-Major-General Bradshaw, in proposing a vote of thanks to His Excellency, said: I rise to move that a vote of warmest thanks be tendered to His Excellency the Viceroy for honouring and encouraging the Congress with his presence on this the opening day. For the first time since the dawn of British rule in India, medical men of all races, creeds, and grades in the country have assembled in force to commune together for the good of suffering mankind, and to promote unity and brotherhood of healers of the sick. This great movement and gathering constitute an epoch in the history of Hindustan in the practice of Western medicine, and with the epoch can hardly fail to be associated the name of the Earl of Elgin, who on this occasion gave the profession the especial countenance and sympathy of the ruler of the Empire.

Mr. Ernest Hart in an eloquent speech seconded the vote of thanks.

His Excellency returned thanks for the very kind manner in which the members of the Congress had passed the vote of thanks, and expressed the great interest with which he had listened to the very important and initiative address which had been delivered by Dr. Harvey.

SECTION

OF

MEDICINE AND PATHOLOGY.

PRESIDENTIAL ADDRESS ON THE FEVERS OF INDIA.

BY ALEXANDER CROMBIE, M.D.,
Surgeon Lieut.-Colonel, I. M. S.

GENTLEMEN,—While I acknowledge the great compliment which was paid to me by my nomination to the distinguished position of President of the important section of Medicine and Pathology at this the first Medical Congress held in this country, I trust you will accept, not as merely formal and customary, but as genuine and heartfelt, my expression of regret that some one has not been selected who might have filled the place I now occupy with more learning, grace and ability than I can hope to bring to your service. In order to minimise as far as in me lies the disqualifications under which I take my place here, I have selected for my presidential address a subject which has an instant and perennial and daily interest for all of us who practise medicine in India, and one to which I have given much thought throughout my whole service, and the importance of which no one will be disposed to dispute. It is now nearly twenty years since I was requested, among other officers serving in Burma at that time, to report on the fevers of that country, and from that time, till now, my mind has never been long unoccupied with the great, important and complex problem which Indian fevers present. To the European living in Europe, on account of the almost theatrical rapidity of its course, its high rate of mortality, and the mysterious way in which it seems periodically to escape from the limits of the endemic area, and carry devastation westwards in a progress which neither rivers, nor seas, nor quarantine are able to stop, cholera looms large in the catalogue of Indian diseases. But we who live and practise in India know that in many parts cholera, as in Europe, is only an occasional visitor, and that even in the endemic areas, where, though it has its seasons, it is never wholly absent, and while it demands its victims in hundreds, fever exacts them in thousands. The number of deaths due to cholera in the whole of India in 1892 was recorded roughly as 750,000, whereas the number of deaths attributed to fevers was, also roughly, 4,500,000. Now if we remember that the death-rate in fevers is probably highly estimated if we place it at two per cent., while the death-rate in cholera is not much below 50 per cent. of the cases, we at once perceive what an enormous amount of sickness, suffering, and disability is comprehended in the words Indian fevers, and what an enormous amount of clinical material there is presented to us yearly for their study. The above figures, worked out, give us somewhere about 200,000,000 cases of fever per annum against 1,500,000 cases of cholera. The pre-eminent importance of fevers in the daily life of an Indian practitioner can, therefore, hardly be disputed, and I need I think make no excuse for selecting them as the subject of my address.

The fevers of India divide themselves into two great classes or groups: In the first of these are those fevers whose course is interrupted by more or less perfect periods of apyrexia, and are, roughly speaking, amenable to treatment by quinine. These are the malarial fevers, and in the second group are the continued fevers, in which quinine is of no avail. With regard to the first, our knowledge is precise and almost complete; with regard to the second it is still hazy and to a large extent conjectural, and yet it is in this second group that are found the fevers, the fatal character of which goes so far to swell the death-rate of India to its huge proportions.

I will speak first of the fevers in which periodicity is the distinguishing character, namely, the *malarial fevers*. It is customary to sub-divide these into intermittent and remittent fevers. With regard to *intermittent* fevers we are all of one mind, and there is no question, and can be no question, as to their position, but of late years there has arisen a good deal of doubt, first, as to whether there is any fever which can be called remittent, and, if so, whether it should be included among malarial fevers. I confess to placing myself among the sceptics for reasons which will presently appear.

Beginning then with those fevers which in their normal or typical manifestations have distinct periods of perfect apyrexia, namely, the intermittent fevers, I would point out in the first place that they do not in India follow the same order of frequency as they do in other countries. In those parts of India in which I have had opportunities of observation, *quotidian* ague takes the first place in order of frequency. At most seasons I would not probably be wrong in saying that 90 per cent. of the cases of ague we have to treat have daily paroxysms of fever and not more than 10 per cent. are *tertian* in type, while *quartan* ague is so rare that it may be practically left out of account. I have only had to treat one case of quartan ague in the whole of my twenty-two years' service in India, though I heard of another case a few weeks ago, but was unable to see it. In other malarial countries the order of frequency is quite different. In the Roman Campagna, for instance, the majority of the cases are tertian, then come quartan, and last of all the quotidian ague. To this fact, the comparative infrequency of tertian and quartan ague, I attribute the reluctance which is still shewn in some quarters in India to accept the amœba of Laveran as the true pathological cause of the symptoms of malarial fever, because in quotidian ague, the amœba is often difficult to find, for the reason of its small size, its often indistinct form, and because it does not go through all the phases of its cyclical life in the blood of the general circulation. In tertian, and specially in quartan ague, it is of large size, well pigmented, and generally requires no great research to find it, and in quartan ague its whole life history can be followed in blood taken at intervals from the finger. To study the most critical part of the cyclical life of the parasite in tertian and quotidian ague, namely, the periods of segmentation and sporulation, blood must be taken from the internal organs. From these remarks you will guess, and I may as well at once confess, that I am a convert to the amœbic theory of malarial fever. It seems to me that it is impossible to offer any longer a reasonable resistance to this theory. Malarial fever is found to exist in widely different parts of the world, in America, Africa, Asia, and Europe, and in localities differing from each other in every particular of climate. Yet under all these varying conditions the phenomena of malarial fever are identical, and point to an identical pathological cause. In all these places, an examination of the blood of patients exhibiting these symptoms discloses the presence of a living organism which is the same in each place, the same in Africa and America as in Bombay and Calcutta; furthermore, the cyclical growth and development of the parasite is found to correspond with the cyclical periodicity of the fever, the apyrexia corresponding with the appearance of the young amœbæ in the corpuscles and the accession of fever with their sporulation and the discharge of their presumed toxin into the blood. If it is to Laveran we owe the discovery of the relation of the amœba to malarial fever, it is to Italian physicians, and especially to Golgi, Marchiafava and Bignami, that we owe the working out of its life history, and it seems to me impossible to resist their conclusions.

Golgi has made quartan ague his special study, and the ease with which the life of the amœba of that form of ague can be studied in the blood of the finger makes it very enticing. Its cycle of life is shortly as follows, and I am glad to have this opportunity of saying that I was able, even with my very imperfect observations, here in Calcutta, to confirm those of Golgi and Marchiafava, as far as I could do so in the single case of quartan ague which came under my observation last year. In the first day of the apyrexia the amœba will be found, perhaps, two or even three in a single field of the microscope as in my case, occupying about $\frac{1}{4}$ or $\frac{1}{5}$ of the invaded red blood corpuscles and exhibiting active amœbic movements. On the second day of apyrexia, it will be found that it has grown so as to occupy half of the blood corpuscle, to have become pigmented at the periphery and to have all but lost its motility. On the third day of apyrexia it will be found to occupy nearly the whole of the corpuscle, and that the pigment has collected towards the centre preparatory to segmentation. The next and last stage of the cycle of life is that of sporulation, and with the discharge of the spores, and of the toxin which the amœba is supposed to form, comes the sudden accession of fever on the fourth day. When this happens over and over again, the same relationship being repeated between the growth and maturation of the amœba and the periods of apyrexia and pyrexia in the patient, it becomes irresistibly borne in on one that they bear an intimate and indeed causal relationship to each other.

The study is more difficult in tertian, and most difficult in quotidian ague, because the amœbæ of these forms of ague cannot always be found in the blood of the finger, retiring as they do to the spleen, brain and bone marrow to undergo their final stages of segmentation and sporulation prior to a renewed accession of fever, and indeed it is sometimes only on *post mortem* examination that the important part they have played in the phenomena can be understood, the number of amœbæ in the general circulation not being always proportionate to the severity of the symptoms. All that is wanted to satisfy the most exacting demand for complete evidence, that the amœba of Laveran is the very cause of intermittent fever, is that it should be cultivated outside the body in some suitable medium, and that when a pure culture so obtained is injected into the body of an animal susceptible to the disease, it should give rise to the symptoms and pathological changes of intermittent fever. Hitherto the amœbæ of malarial fever have baffled every attempt of this kind if it be not true, as was reported a few months ago, that Celli of Rome has succeeded in growing them in some alkaline medium.

It would require a much more prolonged and continuous study than it has been in my power to give to this subject before I could say or ask you to believe, with Marchiafava, that each form of malarial fever has its own variety of the parasite, and that you can tell, by its microscopic characters, which variety is present, and that the specimen of blood is taken from the finger of a patient suffering from quotidian, tertian or quartan ague as the case may be; but it is my firm belief that there is little difficulty in doing so, and my own observations here in Calcutta, as far as they go, go entirely to confirm the observations of the great Italian observers as may be gathered from the phrases I have used in speaking of the parasites of the different forms of intermittent fever, as if they were distinct. I have now seen every form of the amœba, both the endoglobular and the ectoglobular bodies belonging to the semilunar group with the exception of the flagellate forms in patients in the General Hospital in Calcutta, and they exactly correspond with what I saw in Rome, and is described and pictured in Marchiafava and Bignami's book; not only so, but the variety described as that of quartan ague was found existing alone in my case of quartan ague I have alluded to. Here the commonest variety is the annular form found in our cases of quotidian ague exactly like that found in cases of quotidian ague from the Roman Campagna, and the same correspondence will be found also, I believe, in the tertian ague of the two countries.

I now pass to those cases of malarial fever in which there is no distinct intermission. These form an important proportion of the cases of fever treated under the name of remittent fever, and allow me to say at once that we all recognise two kinds of remittent fever, a malarial and a non-malarial, which latter I however regarded as a continued fever; and will consider later as one of the group of continued fevers. But at a certain season of the year, that is, from the middle of September to the end of December, in Lower Bengal at least, a very large percentage of cases of remittent fever partake of a different character, that is to say, they are clearly of a malarial nature, and are equally, with the varieties of intermittent fever mentioned before, amenable to treatment with quinine. There is little room for doubt that this group of fevers the malarial remittents are also produced by the same amœba forms, as produce the intermittent fevers, and that they are in fact intermittent fevers in which either the pyrexial stage is unduly prolonged, owing to the excessive toxic qualities of the organism, so that a new accession of fever comes on before the previous attack has entirely subsided, giving time only for a small remission of the pyrexia previous to the next accession, or they are cases in which there are at one and the same time two sets of organisms in the blood whose cycles of life are parallel, but not synchronous, one maturing, sporulating and discharging its toxin some eight, ten or twelve hours after the other, and thus keeping up a continuous condition of pyrexia. Just as there is a double tertian, so there may be, and in certain of the cases I refer to there is, a double quotidian producing the phenomena, which constitute what is described as malarial remittent fever. I have not made a sufficient number of observations to verify those of Manchiafava who has found corroboration of this theory of malarial remittent fever in the existence of amœbæ in different stages of cyclical growth in the same drop of blood, but I have found the annular forms of the amœba present in cases of remittent fever in no way to be distinguished from those so constantly found in the quotidian form of intermittent. I confess, however, that these are most trying cases to investigate microscopically, at least in the time usually at my disposal for these purposes; and I have in most cases been obliged to form my diagnosis on general clinical symptoms.

We must, therefore, in many cases fall back on general symptoms in differentiating the malarial from the non-malarial form of remittent fever, and the clinical features on which we must depend to justify the diagnosis of an element essentially malarial in these cases are the following: (*a*) the history of a distinctly intermittent character of the symptoms at an earlier stage before they become remittent in type; (*b*) the existence of a more or less distinct remission of the pyrexia at a fairly regular time of the day or night; or (*c*) the occurrence of two remissions, however slight, and two exacerbations in each period of twenty-four hours suggesting the existence of two sets of organisms maturing separately. Observations of this nature require the most intelligent care and record, but when one or other or all of these phenomena are present you know that you are dealing with a case of malarial poisoning, and you must exhibit the antidote, even though no malarial organisms can be found in the blood of the finger.

One more word before I pass to the consideration of the group of continued fevers. It may be asked what practical good is obtained by the discovery of the malarial parasite in the blood. The clinical phenomena are already sufficiently clear to enable us in nine cases out of ten to dispense with the microscope in forming our diagnosis. This is no doubt true, but not to mention the aid to prognosis afforded by the number of parasites present and their effect on the red corpuscles which they have invaded, there are cases in which the diagnosis is not quite easy, and in which the discovery of the parasite would free the mind of the physician from doubt and perhaps anxiety, and enable him to use the antidote with a freedom and confidence which he could not otherwise feel. Thus in my own practice last year I had a case of urinary infiltration which, while apparently doing well, was suddenly seized with rigors and a rapid rise of temperature followed by profuse sweating, symptoms which, under the circumstances, were uncomfortably suggestive of pyæmia. An examination of the blood shewed the presence of the amœba of tertian ague, and led to the administration of a few full doses of quinine, and the cessation of all the symptoms. I venture to think that without the microscope the treatment would not have been so assured or so prompt and effective. In the puerperal state similar assistance would often be of the greatest comfort to us. It is only fair in me to say, however, that in many cases the observer must be prepared for disappointment. The examination must often be prolonged and repeated, and there are various fallacies lying in wait for the inexperienced, and in certain instances where the general symptoms and the prompt response to the action of quinine leave no ground for doubt as to the malarial character of the case; the most patient search sometimes fails to find any organism in the blood of the finger. In such cases the blood of the spleen would probably yield them abundantly. While, therefore, the presence of the malarial parasite in the blood of the finger may be regarded as conclusive of the malarial nature of the cases, failure to find it can in no way justify the opposite conclusion in the face of distinct clinical symptoms of a malarial type.

And here pardon me one moment that I may speak of the efficient use of quinine. There are many practitioners in this country who, from timidity or wrong teaching or some other cause, have no knowledge of, and I fear also no belief in, the power of quinine as an antidote for malarial poisoning. How, when or where, the practice originated I cannot discover, but the belief is widespread among professional men, as well as among the laity, that quinine cannot be safely or efficiently administered except during the period of apyrexia, or at least in remittent fever its administration must be delayed till a remission has occurred, such as to bring the temperature down to some point below 100° Fah. All the best authorities advocate a very opposite plan of treatment, and I am glad to have this public opportunity of recording an emphatic dissent from the popular belief and practice. Careful observations have shown that quinine is most efficient against the malarial organism in the early period of its growth, while it is still unpigmented or only collecting pigment at its periphery, *i.e.*, in quotidian ague during the pyrexia and the crisis. When the amœba ceases to grow and begins to prepare for segmentation and sporulation, that is, just before the rigor and new accession of fever, quinine has little or no effect on it, and I entirely agree with Marchiafava and Bignami, that in malarial remittent, where there may be, and frequently are, two sets of organisms maturing separately and severally, at different times, in the blood, the treatment with quinine should be begun without delay and continued at regular intervals without any regard to the state of the temperature curve. My own practice is to give ten or fifteen grains by the mouth, every four or six hours, according to the severity of the symptoms.

I have never given more than 90 grains in 24 hours, and I usually find one drachm in 25 hours serves my purpose, but in the hospitals of Rome, where they encounter a type of fever of a severity such as we rarely meet with here, and which may prove fatal by coma in 48 hours, physicians administer much larger doses. Their initial dose is seldom less than thirty grains in two doses, at an interval of two or four hours, and pernicious cases they give hypodermic injections of 30 to 45 grains, followed by smaller doses of 15 grains.

If when the time of my leaving India comes I were to leave a message to my professional brethren here, it would be this—treat your cases of malarial remittent with quinine, early in full doses with a free and fearless hand and regardless of the temperature.

Gentlemen, I yield to no one in my advocacy of the freest use of quinine in malaria, but at the same time I deprecate and deplore that indiscriminate use of it in unsuitable cases, which has brought this invaluable drug into so great disrepute among the natives of this country, and has given rise to a dread of it, both on the part of patient and practitioner, which effectually prevents its effective employment in cases where it is the only hope of salvation. In this instance, as in every other, a careful diagnosis is essential. If after a painstaking enquiry the case appears to be one of the second group, of which I am about to speak, the group of continued fevers, withhold quinine or give it sparingly and tentatively, but if you come to the conclusion that the case is malarial, you cannot give it too freely or fearlessly or with too lavish a hand.

I now come to the second group of fevers, our knowledge of which, with perhaps one exception, is unfortunately still vague and conjectural, and in which quinine is not only of no avail, but is sometimes distinctly harmful. I refer to the continued fevers of which I recognise with certainty three, and probably five, as specifically distinct. The three whose differentiation I regard as indisputable are *simple continued fever*, *typhoid fever*, and *non-malarial remittent*, so called—the other two, whose title to a distinctive name you may be disposed to doubt, are fevers especially of towns known locally as "*Calcutta fever*," "*Bombay fever*," etc., which runs a course very similar to that of typhoid fever without any of the symptoms of that disease, and lastly there is a low continued elevation of temperature of indefinite duration and without any distinctive symptomatic features, and known simply as "*low fever.*"

I do not propose to allude to ephemeral fever, of 24 hours duration and due to chill or slight exposure to the sun, or to that extremely sudden severe and fatal form of fever called insolation or sun-stroke, or the cerebro-spinal or typhus fevers, but I would venture to remark that whatever the returns of the armies, both European and Native and of civil hospitals and jails, may seem to say to the contrary, the most common fever of India is not ague. The fact that "ague" takes the first place in the returns is merely due to a looseness of nomenclature which leads medical officers, at the instance generally of their subordinates, to return as "ague" every case of fever of short duration, as well as those which shew the intermittent character which entitles them to that name. I was a very short time in India before I began a fight on this subject—a battle which continues even unto this day. To my mind no fever is entitled to be called ague which does not conform to a certain type, that is to say, unless its course is interrupted by intervals or more or less complete apyrexia.

Now in the parts of India where my lines have fallen a type of fever with this essential character has at no time or place been the prevailing one, as the returns referred to would lead one to suppose, and if you were to refuse to accept as ague all cases of fever except those in which intermission was an essential feature, you would sweep away at once some three-fourths of the cases now returned under that name. In certain months of the year, that is to say, in October, November and December, true agues are more frequent than at other seasons, but even then they, by no means, constitute the majority of the cases, and for nine months of the year it is often difficult, even in a large hospital, to find a case of genuine ague for weeks at a time.

The cases which are thus wrongly returned under the heading of "ague" are really cases of "simple continued fever," a fever often ushered in with a rigor, a very high temperature and evidence of great gastric disturbance. I have known the temperature reach 106° Fah., within a few hours of the commencement of the symptoms, but more usually the ingress is more gradual, though the headache and gastric symptoms are generally very distressing. The duration of the case is generally from three to eight days, and there is often much doubt whether it will or will not pass into typhoid when the patient is a European, and especially if he is living in a drained town.

Such cases are examples of a distinct type of fever which has been recognised and described by all the best authorities under the name of simple continued fever—a name to which there is no objection. But instead of determining within a week it is not very unusual, especially during the cold season and early summer, for these cases to continue for a longer time, and then we look for defervescence about the 14th, 21st or 28th day. These cases are particularly common in towns and are known as "Calcutta fever," "Bombay fever," etc. It is open to any one to assert that these are cases of mild typhoid fever, and that those which recover early are merely abortive cases of that disease. It is, however, I think impossible for one accustomed to treat considerable numbers of cases of true typhoid fever, and who also has opportunities of watching the imperceptible gradation of cases of simple continued fever into the cases now under consideration, not to notice distinct differences which forbid him to concede more than that certain mild and abortive cases of typhoid may be mistaken for cases of the continued fever of our towns. I am one of those who are unable to admit that the whole philosophy of continued fever in India can be epitomised in the word typhoid. I cannot admit that the bacillus of Eberth is the only organism capable of giving rise to a febrile curve of three or four weeks' duration. As a matter of fact, it is known, and has been experimentally proved in animals, that a bacillus normally present in large number in the human intestine, the bacillus coli communis, is capable under certain conditions of becoming virulent and then endowed with a power of producing a fever and even pathological appearances, including ulceration of the bowel, hardly to be distinguished from those of typhoid fever. It has always, therefore, seemed to me to be narrow and unjustifiable to classify as necessarily typhoid every case of continued fever of three or four weeks' duration. If the bacillus coli communis is sometimes endowed with this power, why not also some other organism or organisms as yet unknown? With the knowledge of this possibility before my eyes, I have been accustomed to insist on the presence of certain symptoms resembling those of typhoid fever before being prepared to concede that any given case of continued fever is one of that disease. Now such symptoms in the cases I refer to are conspicuous by their absence. It is true that genuine cases of typhoid fever, often in this country, present remarkable variations from what may be considered as typical of the disease described in text-books. I need only allude to the frequent absence of that gradual step-like rise of temperature during the first three or four days which is so characteristic of typhoid fever in Europe. Instead of that we quite frequently, and I believe it to be the rule here, have a sudden rise to 104° on the first and subsequent days. I need not mention the alleged more frequent absence of the characteristic eruption here, because I do not think it is more often absent here than in Europe, and even if it were, it is not so much the absence of spots which constitutes our difficulty of diagnosing typhoid in India, but rather the superabundance of spots, at least in the hot weather and rains, when the whole body is covered with prickly heat, in the exuberance of which it is as hopeless to pick out typhoid spots as to find the proverbial needle in a bundle of hay. Neither do I speak of the difficulty of seeing the spots on pigmented skins, because, as I have pointed out elsewhere, the native races of India exhibit a marked immunity from typhoid fever, with the exception of the lighter coloured races, the Gurkhas and Burmans, and perhaps other meat-eating and dram-drinking people. Neither do I speak of the relative frequency of constipation in typhoid fever in India, because I do not think it is more common than in Europe; and because I believe that the constipated motion of a genuine case of typhoid with its appearance of orpiment paint is as characteristic of the disease as are the pea-soup stools of typhoid diarrhœa. But what I maintain is that we are not justified in designating as typhoid fever cases which have neither the gradual initial rise nor the eruption, nor the characteristic stools, whether loose and like pea-soup, or constipated and like yellow coach paint, cases in which the tongue continues clean and moist, or simply coated as in any febrile condition, and in which the mind is clear throughout unless you give quinine. I say we are not justified in calling such cases, in which all the symptoms of typhoid fever are absent, enteric fever, simply because they have a duration of three or four weeks. I demand that some one or more of the ordinary symptoms of typhoid fever should also be present. Neither will I admit that even hæmorrhage from the bowel necessarily removes them to that category if it be true that other febrile infections besides that of typhoid may also give rise to intestinal ulceration. I believe that these cases, which I am now describing, and which are so sharply differentiated from typhoid fever by the whole clinical picture which they present, constitute a specific disease, and must have a specific and separate cause distinct from the bacillus of Eberth.

A very few words will suffice to dispose of the next form of continued fever. It is one which is only occasionally met with among Europeans, and I do not think I have met with it in natives in India, but if it does occur among them it would hardly be brought under my notice. I refer to a persistent low elevation of temperature unaccompanied by any constant symptoms of indefinite duration, and uninfluenced either by quinine or arsenic. The temperature never falls below 99° and rarely rises above 101·5. It may continue for several weeks without complication except, perhaps, a tendency to diarrhœa of a bilious character, with loss of appetite, and gradual loss of strength and flesh. Some of these cases are distinctly aggravated by quinine, and I have known them cease abruptly on withdrawing the drug which had been persistently given in the belief that the condition was malarial in its essential nature. These cases are spoken of as "*low fever*" and are generally cured by a "change" of any kind, but especially by a trip to sea, and it is especially this form of fever which in Calcutta is benefited by a visit to the Sandheads. Though very ill-defined, these cases constitute a distinct type of fever at once recognised when met with.

Widely different from this "low fever" is the last form of continued fever of which I have to speak, namely, the *non-malarial remittent* (so-called). It is a pity we have no better name for this fever, which is of very frequent occurrence, and is one of the most fatal of our fevers. The designation "remittent" is a misnomer. It is no more remittent, and indeed often less so than typhoid. The temperature is generally very high, touching 104° and 105° for a long part of its course, and the daily fluctuation not exceeding 2° or 2·5°. It begins in a way not unlike the cases I have described under the name of "Calcutta fever," "Bombay fever," etc., and is by some considered to be a variety of typhoid fever, notwithstanding its divergence from all the symptoms of that disease. Hepatic enlargement and congestion are early and constant conditions; but the spleen, as a rule, continues impalpable below the ribs.

Bilious diarrhœa, in no respect resembling the diarrhœa of typhoid, is also a very frequent symptom—quinine often given in large and repeated doses in these cases is not only not useful but so obviously adds to the distress of the patient without in any way producing an improvement in the progress of the symptoms that it is very soon abandoned. Meanwhile the temperature continuing persistently high marked head-symptoms, especially delirium of a muttering and irritable kind, comes on, and the patient may even, and often does, pass into a condition of coma from which he can hardly be roused. This condition, one of persistent high temperature without any marked remission, a distinctly enlarged and congested liver with bilious diarrhœa, congestion of the back of both lungs, and a low muttering delirium is generally reached by the 18th to the 24th day. If coma supervenes, the patient frequently dies about this period. In more favorable cases where the symptoms are less severe they continue for a week or two more, and the average duration of the case is six weeks. None of our drugs seem to be of any use in shortening it, certainly not quinine, the inadequacy of which in these cases has now become fully recognised, though the disease has not yet found a name or place in our nomenclature.

Though I have seen this fever in Europeans, it is essentially a disease of natives, and is not common after thirty years of age, though frequent enough in childhood. Like every other continued fever in India, this also has been called typhoid fever, though it is difficult to conceive a condition more distinct from it in its symptoms or course. This is the fever which offers the highest promise to the enquirer of the near future. It is obviously not a malarial fever, and no unprejudiced observer would for a moment class it with typhoid, and yet it has such a perfect and constant clinical course that it must have a special and specific cause, some organism which is waiting its discoverer. Such a discovery has at last been made with regard to "Malta Fever," a fever long and persistently considered to be typhoid, but now proved by the researches and experiments of Bruce, Gipps and Hughes of the Army Medical Department to be as distinct clinically, pathologically, and bacteriologically from typhoid fever on the one hand as it is from malarial fever on the other. It has been my fortune to watch some twenty cases of Malta fever in the General Hospital, and it is difficult to understand how it could ever have been regarded as related, even to typhoid fever, so different is it in its clinical character alone. The gentlemen I have named have succeeded in isolating the organism which is its essential cause, and have been able in six instances to induce an analogous fever in monkeys by means of pure cultivations of the "micrococcus melitensis" as it is called. Malta fever has no congener in India, but should not the success of Bruce, Gipps and Hughes stir us up to a scientific investigation of our Indian continued fevers? These investigations are not really difficult. Their essential requisites are a few simple stains and a patient looking through the tube of a microscope. We have allowed a Frenchman to find in this way for us the amœbæ of our malarial fevers and a German the comma-bacillus of cholera, which is surely our own disease. Shall we wait till some one comes to discover for us the secrets of the continued fevers which are our daily study, or shall we be up and do it for ourselves? It may be that I have wearied you with my address, the subject of which is necessarily one of technical detail. It may be that you differ from me entirely in my opinion as to the nature of the fever which I have now attempted, however feebly and imperfectly, to differentiate and classify; but if I have succeeded in rousing any of my hearers, or any of those who may do me the honor of reading my remarks to a more careful clinical study of the cases which come daily under our observation in this enormous field for clinical study in which we work—and there must be many better qualified for the task than I am—and especially if I can hope to rouse in those, who have more leisure than I, the determination to study these fevers bacteriologically and to make a precise knowledge of their true nature our own, I shall be content and think that I have perhaps not written and spoken in vain.

VOTE OF THANKS.

Dr. Bickle (South Australia) moved that the best thanks of this section be tendered to Dr. Crombie for the very able, thoughtful and instructive address to which they had just listened—an address which embodied the careful observations of the professional life of the honoured president of the section.

He had especial pleasure in being present and felt honoured in being allowed to move this resolution, inasmuch as in Australia congresses such as these had been held, and the particular colony he represented had been the one to initiate and carry to a successful issue the first congress in the Eastern Hemisphere.

He had been repeatedly asked by laymen what good could be expected to be derived from these congresses. His answer had always been that they had a three-fold use. *Firstly*, they stimulated research in the collecting of material for the papers to be read; *secondly*, the reading of these papers before others and the thorough interchange of ideas and opinions at the meetings and the various social functions was productive of much knowledge being acquired and diffused; and, *thirdly*, the publication of the transactions was a permanent record of the work done and the advances made. He appealed with every confidence to the members present as to whether they had not in the address they had just listened to a complete justification of the reasons he had advanced as to the uses of congresses and address which could not fail to stimulate further observations of the important issues raised by the lecturer. He had the greatest pleasure therefore in moving that the heartiest thanks of the section be accorded to Dr. Crombie its president.

The vote being seconded was carried heartily with acclamation.

OBSERVATIONS ON CHOLERA IN INDIA.

BY E. H. HANKIN, M.A.

To be able to recognize the microbe of Asiatic cholera in water or in dejecta is a matter of great practical importance. Until recently this was a matter of great difficulty, and even for the most expert bacteriologists it was little better than a matter of chance; but, in 1893, Koch published a paper dealing with the question in which a simple reliable test for the cholera microbe was described. The test depends on the fact first noted by Dunbar that the cholera microbe flourishes luxuriantly in a solution of peptone. If this substance is added to water containing the microbe of cholera besides other bacteria the former will reproduce in most cases more rapidly than others; and in twelve to twenty-four hours will form a fine pellicle on the surface of the liquid, from which the cholera microbe may be isolated in a pure culture with facility.

Soon after the publication of this paper, Metschnikoff, Sanarelli, and others, published accounts of the finding in water, at places where no cholera existed at the time, of microbes practically undistinguishable from that of cholera. Large numbers of persons using this water were in perfect health; these microbes therefore were completely harmless. These discoveries threw no doubt on the authenticity of the cholera microbe as the cause of cholera; but they threw great doubts on the tests for the cholera microbe described by Koch. The discoveries came to the conclusion that there existed in nature a number of harmless microbes that could not be distinguished from that of cholera by any known test; and that therefore it was impossible to say whether a specimen of water contained the microbe of cholera, or whether it merely contained a harmless microbe that has a similarity to it. It was, however, also suggested that these cholera-resembling microbes were in reality the true cholera microbe, but in a state of degeneration. So far as I know no proof has hitherto been given of the truth of this suggestion. I propose in this paper to attempt to fill this hiatus.

Commonly, in an European town, there are at most two or three sources of water in use. In an Indian town, on the contrary, there are usually hundreds of sources. In some places, as Cawnpore, there may be a well in almost every house. Each of these wells may contain the cholera microbe under different conditions. This peculiarity no doubt complicates the questions connected with the distribution of cases in a cholera epidemic, and makes their explanation more difficult. But for the present purpose this was an advantage, for in a single outbreak in a town it was possible to meet with the cholera microbe in a state of degeneration under a hundred different conditions, and to see in each case whether it continued to exist in the well water, in a degenerated condition, after the epidemic had passed away.

If the above-described view is correct, namely that the cholera-resembling "vibrios," discovered by several authors, are really nothing more than cholera microbes in a state of degeneration, then one would expect to find that during cholera epidemics a "vibrio" would be present in well water; and that, after the cessation of the epidemic, the vibrio would be found showing various characters of degeneration, and that at a later time no trace of a vibrio would be detected in the water.

My experiments to test this point have been carried out with the co-operation of Surgeon-Colonel Hutcheson, the Sanitary Commissioner, N.-W. P. and Oudh, who arranged to have sent to me specimens of well water from different towns at intervals of a month. In each case, a town was chosen in which cholera was present during the past summer, and water from the same set of wells was sent to me on the different occasions. In some cases I can quote observations made personally on the spot. The results are as follows:—

Cholera was very prevalent in Lucknow during the past summer, reaching its maximum during August and dying out in September. In October, I detected a vibrio in five samples of well water out of ten that had been sent to me. In November, it was found in eight out of twelve; and in December it was found in only two out of twelve. Thus, in this case, microbes resembling that of cholera vanished from the water in the great majority of cases within three months of the cessation of the epidemic. Out of seventeen wells in the Sadr Bazaar, in Lucknow, where cholera did not exist in epidemic form in the summer months, a vibrio was only detected in two. The tests were carried out early in October. At the same time water from the same number of wells on the road leading from Lucknow to Fyzabad were tested, and a vibrio was only detected in one. This well was situated near the cholera camp, where portions of the East Lancashire Regiment had been encamped during the outbreak in that regiment. As I am on a commission of investigation into this outbreak I am unable to say more than that there is no reason for connecting this well with any part of the outbreak among the troops. For the same reason I also do not think it well to refer to the results of a search for cholera microbes in different parts of the East Lancashire lines, beyond saying that the results confirm the conclusions that I shall arrive at in this paper. At the time when cholera was prevalent in the East Lancashire Regiment an investigation was made into the water-supply of the 16th (Queen's) Lancers who remained free from the disease. Of seven specimens of water examined, taken from wells, the dairy, and the soda water factory, a vibrio was only detected in dirty water used for washing the soda water bottles. This had very probably been carried by the coolies engaged in this work from the native parts of the town.

In Fatehpur, the cholera reached its maximum on the 29th July, and had died out by the 18th August. A vibrio was detected in four out of six specimens of water examined in August. Specimens from the same six wells were examined in October, and again a vibrio was found in four cases. In November, it was only detected in one out of six; and, in December, it was not found in any of the samples. In this case, again, the vibrio had vanished in the majority of the cases in the third month after the epidemic, and in the fourth month it had completely vanished.

In Etawah, the cholera reached its maximum in August and ceased in September. Four wells were examined in October, and a vibrio was detected in two. In November, it was not detected in any of the four wells examined. Here the vibrio vanished within two months of the cessation of the epidemic.

In Unao, the cholera existed at the same time as in other places mentioned. The vibrio was found in thirteen out of fourteen wells examined in July, that is to say at a time when cholera existed. In October, it was found in six out of seven wells examined. In November, it was detected in eight out of fourteen. Here, unfortunately, the experiment was interrupted, as owing to a mêla the Civil Surgeon thought it necessary to disinfect the wells.

Cholera assumed large proportions in Cawnpore during August, having commenced in May. It ceased in September. I spent three days in August making observations in Dalelpurwa, a quarter of the town that had been most severely affected, but in which, as subsequent events showed, the epidemic had practically ceased. Here I found the cholera microbe in nearly every well in the place. However it already showed some signs of degeneration, in that in each case the colonies that it formed on agar were minute and difficult to detect. They also grew more slowly than usual. The microbe was only detected in one out of fifteen wells sent to me in October. Thus, within one month of the cessation of the outbreak, the cholera microbe had vanished nearly completely from the water.

I believe that it is a rule that when cholera is prevalent in a town for isolated cases of cholera to occur among troops in neighbouring cantonments. In days gone by such cases used to be explained by ascribing them to the "miasm" or to the "variations in the level of the subsoil water" that were supposed to cause cholera. At the present time they are usually ascribed to the unfortunate individuals having picked up the infection in the Sadr Bazar, even in cases in which no evidence exists as to their having gone out of bounds. In the present case, during the epidemic in the town of Cawnpore, dropping cases of cholera existed among the troops, and some of them had been moved into a "preparatory camp" outside their barracks. Luckily I examined the well water in use, and was able to show that it did not contain the cholera microbe; and, as is usually the case with covered-in wells, so far as my experience goes, the water was distinctly good. Thus the Medical Officer in charge was spared some anxiety, and the soldiers were saved the risk involved in having to use water from a new and untried source. I paid a visit to the regimental coffee-shop and cook-house, and took away with me specimens of everything that could possibly be put in into a bottle. Out of thirteen specimens examined the cholera microbe was detected in three. As above mentioned, the microbe was not detected in the drinking water in use in the regiment. Neither was it present in the water used for washing purposes. Neither was it present in any wells, that I could find, that might have been used by the *bhistis* had they disobeyed orders. At the time that I went into the cookhouse, the floor had been recently cleaned, and I collected some water from the drain on the floor. Here the cholera microbe was found in a state of full virulence. It was tested on a guineapig, and found to kill the animal in 6½ hours. The cholera microbe was also found in some milk that had been set aside for the men on guard, who were allowed to have a cup of tea in the early morning. This vibrio killed a guineapig in eight hours, and consequently may also be described as fully virulent. The cholera microbe was also found on some chopped meat. This killed a guineapig in ten hours, and therefore was also virulent. I think there can be no doubt that these cholera microbes had been carried from the native part of the town by the coolies employed as "cook's mates." It appears to me that these discoveries of the presence of cholera microbes in and on food, in the regimental cookhouse, make any other hypothesis as to the origin of the isolated cases of cholera that were appearing among the troops unnecessary. In the native town the cholera microbe was practically everywhere. There is no sewage system. Shallow surface drains exist in every street. At the time of my visit it seemed to me these drains contained cholera dejecta with very little other liquid to dilute it. In some of the smaller streets the drain ran along the centre of the road, and it was impossible to walk along without placing one's foot at every step in cholera dejecta. In one room I saw a man dying of cholera. The evacuations went on to the floor, and thence out by a hole in the wall into the street. The room was about eight feet square. On the floor was lying the brass vessels, and the rope used for drawing water. The well that furnished the water used by the household was in a corner of the room. This was in one of the largest streets in the towns. In one street I saw a native who wanted to clean his brass drinking vessel. Natives usually scour these vessels with earth. In this case the earth was hard, and the man could not scoop any into his hand. He happened to be standing in the gutter, and seeing, by him, one of these holes in the wall of a house that serve as an escape for sewage, he plunged his hand into it and pulled out a handful of black mud with which he cleaned his drinking vessel.

Everywhere millions of flies were settling on the filth and cholera dejecta in the drains, and then settling in crowds on the food displayed in the shops. It is known that flies are active agents in the diffusion of disease, and this being the state of affairs it is no wonder that cholera was prevalent. It appears to me to be very important that men engaged in handling the food of British soldiers should be prevented from going into places where such a state of affairs exist.

These cholera microbes from the regimental cookhouse which, as I have suggested, came from the streets of the town, made large-sized colonies on agaragar, and were isolated readily enough, though owing to press of time I had to do this part of the work while travelling by rail. The microbes from the wells in the native part of the town, where I chiefly worked as already stated, were only isolated with difficulty and formed minute colonies on the food materials. Unfortunately I did not test their virulence on guineapigs. Thus, though I have no proof of this, I think it very probable that they had a slight degree of virulence. The fact that they died out within a month in the well water suggests also that they were degenerated at this time. In Cawnpore the cholera this year began in May. The epidemic showed a great exacerbation after the rains had set in. It is usual to suppose that this phenomenon has something to do with the variations in the level of the subsoil water. I suspect that the appearance of cholera has as much to do with the changes in the level of subsoil water as has the appearance of snipe in a jhil. Both the presence of the birds in the swamp and of the microbes in the streets are coincident in time with a variation in the level of the subsoil water. But I see no reason to imagine that it is anything more than the presence of water on the surface that favours the organism in either case. The above-described phenomenon shown by cholera in Cawnpore and other places can be readily explained with the help of the known qualities of the cholera microbe, without any reference to subsoil water or any need to invoke unknown or mysterious factors whatever. When the cholera infection first reaches the town in the hot weather it is limited for its means of propagation to the well water. Owing to the intense heat and dryness of the air during the hot weather the microbe is quickly killed when the dejecta containing it are exposed in the streets. It may be remembered that no microbe is so easily killed by drying as that of cholera. During the hot weather flies only travel about out of doors in the morning and evening. After the commencement of the rains, a different state of affairs exist. The surface of the ground is moistened, and the rate of evaporation is diminished. The sky also is frequently clouded. The bactericidal action of sunlight is therefore lessened. Flies at this season stay out of doors during the greater part of the day. For these reasons it is inevitable that cholera microbes have better chances of continuing to exist in the streets, of being carried about by human intercourse or by flies, and thus of finding their way on to food, &c., than they have in the hot weather. Very probably this is the cause of the exacerbation of the outbreak that is so often observed at this time. In Cawnpore, on the occasion in question, I believe the epidemic ceased abruptly on the occurrence of a severe downfall of rain. Some people who have much greater experience of cholera than I can lay claim to have told me that this relation is constantly observed. Others, on the other hand, say that no such relation exists. I have had no opportunity of examining the meteorological and epidemiological records which ought very easily to settle this point. If it is true that such a relation exists, it appears to me that an explanation is ready to hand. The heavy rain obviously washes the streets and removes most of the dejecta and cholera microbes. In this way the opportunities of infection of food, &c., ought to be diminished. I am told that the cessation of the epidemic after a heavy downfall of rain is so sudden that it can scarcely be explained by reference to a change in the level of the water in the wells, and to a consequent diminution in the daily dose of the microbe drunk by the inhabitants.

In the Gonda district I found vibrios in a large number of specimens of water from wells in various villages. A vibrio was met with in four out of ten wells in Balrampur which were examined at a time when cholera still existed. In Dhusaha it was found in three wells. One well and a tank in this village did not contain it. Cholera was still present in the village. No vibrio was detected in well water from the village of Suganagar three months after the cessation of the epidemic. It was found in the water of five villages, at intervals of one to two months after the cessation of the epidemic. Out of thirteen samples from these villages, the vibrio could only be isolated from the water of two wells situated in a village in which cholera existed at the time, in spite of repeated attempts. In every other case the microbe refused to grow on solid media. In one case it was isolated from well water (in another village) which had shown no evidence of infection for several days. This was found to be harmless to a guineapig. A similar result was obtained in a parallel case.

In and near Shahgunj (a suburb of Agra), a vibrio was found in 18 wells out of 24 examined during a restricted cholera epidemic. Seven of these wells were disinfected. A month after the cessation of the epidemic a vibrio was not to be found in a single well in Shahgunj. It was met with in one well in the neighbourhood (Rooimundi). This vibrio was isolated with difficulty on agaragar. It was injected into a guineapig, and the animal died after 18 days. No *post mortem* examination was however made, but I think it scarcely probable that the death of the animal had to do with the inoculation. At the time of the epidemic, I isolated the vibrio from all the wells that contained it on solid food media with ease. These vibrios formed large-sized colonies. One was tested on a guineapig and killed it in 17 hours.

During August, when cholera was so prevalent in the rest of the provinces, Agra remained nearly free from the disease. During August, however, diarrhœa was very prevalent in the town. It is possible that this was due to the cholera microbe being present in a weakened condition. On two or three occasions I have had opportunities of examining water that was suspected to have caused diarrhœa in Agra. In each case a microbe indistinguishable from that of cholera was detected. Possibly this epidemic of diarrhœa has to do with the fact that, in October, I found a vibrio in six out of twenty wells tested in a suburb of Agra near the Bridge of Boats, and on a side of the river where the municipal water is not laid on. The same wells were examined two months later, and a vibrio was only detected in two instances.

To summarise these results: We have seen that in a large number of localities, situated often under very different climatic and other conditions, "vibrios," that is to say microbes, resembling that of cholera, are extremely rarely to be found except in places in which cholera has recently existed. During the epidemic, so far as tested, they generally show virulence, power of giving the indol reaction, and other characters regarded as typical of the cholera microbe. After the cessation of the epidemic, they show a greatly diminished virulence for guineapigs; and, in their limited ability to grow on agaragar, they show a diminution of vitality that, I think, may safely be regarded as an indication of diminished virulence. Such degenerated vibrios show great tendency to die out in ordinary cultures, so that it is difficult to keep them alive for any time in the laboratory. The conclusion from these researches is, I think, inevitable that these vibrios are nothing more than the microbe of cholera in a degenerated condition. Whether such vibrios can, under any condition, ever regain their vanished virulence, and thus again become capable of starting an epidemic, must be a subject for future research. This is, I believe, the first time that it has been shown that the cessation of an epidemic is due to a weakening of the particular microbe involved.

A small number of exceptions to this rule can, however, be quoted. I found the cholera microbe in a disused tank in Agra ten months after the cessation of an epidemic in the neighbouring syces' lines. As shown by an experiment on a guineapig it was in a fully virulent condition. The tank was pucca, and at time of examination only contained black stagnant mud. It was difficult to reach down to the level of this mud, and for this reason I do not think that it had recently come into use for drinking or other purposes. I have little doubt that if a shower of rain had filled up the tank, and if it had been used, a cholera outbreak would have resulted.

My observations, made at the Magh Mela at Allahabad in the spring of 1894, have some interest in this connection. I believe no cholera had existed in or near Allahabad for a long time before the mela. The "great day" was 5th February; but the site of the camp was crowded with pilgrims for weeks before and after this date. On this "great day" it is calculated that over 2,000,000 pilgrims visited the bathing ghat. The sanitary arrangements in the camp were wonderfully complete and successful. The cleanliness and freedom from smell noticeable in the camp presented a marked contrast to the conditions to be met with in the neighbouring village of Daragunj. This was situated on the bank of the Ganges outside the limits of the camp, and about a mile above the point of junction of the Ganges and the Jumna. I arrived in Allahabad on the 3rd of February, and on that day collected nearly sixty samples of water from different wells and tanks in or near the site of the mela. Out of the total number of specimens of water examined vibrios were detected in eleven in the peptone culture, but I only succeeded in isolating them on agaragar in four instances. The following table gives their sources and the results of their injection into guineapigs:—

(1) Junction of Ganges and Jumna ...	Death after 32 hours.
(3) Dharma Bibi Well	" " 102 "
(3) Tank near river opposite Daraganj	" " 15 "
(4) Catch pit receiving drains of Daraganj	" " 24 "

On February 16th I paid a second visit to the Allahabad fair. At this time the majority of the pilgrims had dispersed. Cholera also had broken out in Daraganj, and in the town of Allahabad. On this occasion I searched for the cholera microbe in sixteen specimens of water, including all those in which I had previously found a vibrio. Of the eleven specimens in which the vibrio had previously been found, it had vanished in all except in those from Daraganj and the junction of the Ganges and Jumna. It was found in one locality in which it had not previously been detected, namely in the ditch opposite the Dharma Bibi Well. I succeeded in isolating these vibrios in each case, and the results of their injection into guineapigs are as follows:—

(1) Ditch opposite Dharma Bibi Well ...	Death in $21\frac{1}{2}$ hours.
(2) Junction of Ganges and Jumna ...	" $13\frac{1}{2}$ "
(3) Catch pit receiving drains of Daraganj	" 4 "

Specimens of water from three wells in Daraganj were examined. They contained 48,000, 29,000, and 120,000 microbes per cubic centimetre respectively, but the cholera microbe was not among them.

I have not previously published an account of these observations, because I could not be sure of their import until I had obtained the results described in the earlier portion of this paper. Taking these results into consideration, the conclusion is, I think, inevitable that the vibrios that I found on the occasion of my first visit to Allahabad were degenerated cholera microbes. Of the eleven vibrios found six came from wells. The rest were obtained from tanks and from the river. It would seem probable that their appearance in these different localities was connected with the large amount of contamination of the wells and tanks owing to the great concourse of pilgrims. Their rapid disappearance after the dispersal of the pilgrims is an indication of what I believe to be a very general rule, namely, that the cholera microbe degenerates rapidly when it gets into well water. This conclusion is based both on the above observations and on what I believe to be a wellknown epidemiological fact, namely, that, if the cholera virus (in these provinces) gets into well water it loses its virulence within eight days under ordinary conditions. In support of this conclusion I can quote the following observations made during a mela held last November in Fyzabad. No cholera existed at this mela, but during the mela the cholera microbe appeared in the well water. On the 21st October water was sent to me from the Civil Surgeon of Fyzabad from three wells. None of them contained the cholera microbe. On the 10th November water was again sent to me from the same three wells. In each case it contained the cholera microbe. At this time the pilgrims were collecting for the mela that was held on the 14th and 15th November. The cholera microbe from one of these wells (that at Singar Ghat) was isolated and injected into a guineapig. The animal died after thirteen hours. On 17th November, water was again sent to me from the same three wells. The cholera microbe was again detected in two of the wells but had vanished from the third. It appeared to be present in smaller quantity as it could only with difficulty be found in the peptone culture. It was isolated from the same well as before and was found to kill a guineapig in sixteen hours. Thus we have slight evidence that the cholera microbe was degenerating in this well water. That it would increase in numbers in this well water is shown by the following experiments. A cholera microbe from the Balrampur district was used. Some water from the Singar Ghat well in Fyzabad that had been collected on the 13th November was sterilised and inoculated with the above mentioned microbe. Plate cultures were made with the following result:—

Numbers of microbes present after

	0	1	2	3	4	27 Hours.
Singar Ghat ...	350	400	950	750	350	72,000
Gopal Munda...	350	350	1500	450	700	120,000

The cholera microbe employed had previously been grown in a weak peptone solution. Further cultures were made on the following day which showed that in the case of Gopal Munda water there was a pure cholera culture, but a foreign microbe had got into the other culture and to a slight extent had reproduced.

In other experiments a series of bulbs were blown on a glass tube. Between each pair of bulbs a tight plug of asbestos was placed. An opening was made on each bulb, through which samples of the culture fluid could be removed for examination. Each bulb was half filled with tap water, to which was added some human epithelium as an example of an impurity likely to get into well water during a mela. The bulb at one end of the tube was inoculated with a cholera microbe from Shahgunj. The same bulb was also inoculated with some bouillon that had been allowed to become impure and contained a variety of microbes. The necessary control experiments were made, which showed that this bouillon did not contain a cholera microbe and that the cholera microbe was absent at first from the other bulbs. Every day the liquid in the different bulbs was examined. The cholera microbe was found to travel in the course of two days to the other end of the tube and was to be seen in abundance in the microscopic specimens made from each of the bulbs. Though it thus gave evidence of its being able to reproduce in the presence of other microbes under these conditions, it also appeared to have become degenerated, for though before being put into the bulb it grew readily enough on agaragar, it afterwards showed signs of degeneration, in that it refused to develope on this substance.

Thus, it is probable that the cholera microbe gradually degenerates in well water during melas, though it can reproduce in such water at any rate in some cases.

The cholera microbe was present in the water at the bathing ghat at a time when two million persons or thereabouts drank of the water in a single day. There is no reason for supposing that it caused cholera in any case. This, no doubt, is owing to the comparatively low degree of virulence that it possessed.

Though there is reason for thinking that the cholera microbe thus degenerates rapidly in well water, there is no similar reason for thinking that conditions may not exist in which it can maintain its virulence. Indeed the observations made on the cholera microbes in the catch pit at Daragunj go to support this view. This is a hole in the sand on the banks of the Ganges about three feet in diameter that contained stagnating water, and had a small drain running into it from the village. This water on the occasion of my first visit was found to contain over three million microbes per c.c. The cholera microbe then obtained from it killed guineapigs in 24 hours. A fortnight later the water that was trickling into it from the village was examined. It contained a cholera microbe that killed a guineapig in 4 hours. Haffkine kills these animals in 6 hours. The time between inoculation and death seems to be very constant for the same virus when tried on several guineapigs. It varies but slightly with the age of the animal, and still more slightly with the dose.

The fact that no cholera microbe was present in the well water in Daragunj is, I imagine, the reason for the smallness of the epidemic that was going on at this time. Infection could only happen in the comparatively few cases in which the microbe was carried on to food, &c. If the microbe had been present in either of the three wells mentioned, all of which were used by numerous pilgrims, it is extremely probable that a serious outbreak would have occurred.

The foregoing researches illustrate both the strength and the weakness of the bacteriological test for the cholera microbe. There can be little doubt that the vibrios that I have dealt with are, in the immense majority of cases, at all events nothing more than cholera microbes in a more or less degenerated condition. My researches are distinguished by their quantity rather than by their quality, but they have a certain interest from the fact that it is the first time that the test for the cholera microbe has been applied on a large scale in India. I had hoped to test the virulence shown by the cholera microbe on animals in a series of wells during an epidemic, and then to repeat the test after the epidemic had passed off. This I was unable to do, except in a few isolated cases owing to the fact that after the epidemic the vibrio had so far degenerated that it was incapable of growing on solid food materials. That this degeneration, so far as the power of growing on agaragar is concerned, is connected with a decrease of the virulence has, however, been independently proved by Sanarelli. Out of 32 vibrios isolated by this author from water in Paris and its neighbourhood, only four (which grew readily on agaragar) showed a well marked pathogenic power on animals, the others, many of which refused to grow on ordinary agaragar, either had no effect on guineapigs, or only killed them after the lapse of several days. At first, when I was unable to isolate the vibrio on agaragar, I ascribed my failure to want of skill, but now I have had so much practice at this work that this explanation can scarcely hold good. On several occasions during cholera epidemics I have succeeded in obtaining isolated cholera colonies on agaragar from peptone cultures, in which the cholera microbe was present in so small quantity that I was unable to see it on microscopical examination.

A CONTRIBUTION TO THE ETIOLOGY OF CHOLERA.

BY MONS. W. M. HAFFKINE AND W. J. SIMPSON, M.D.

Koch, in his investigations into the cause of cholera, directed his attention to the micro-organisms found in man, and particularly to those to be found in the intestines. By comparing the intestinal flora of patients suffering from cholera and other diseases with that of healthy men he was enabled to single out the comma bacillus as the organism peculiar to cholera. This is the direction which observers engaged in the working out of the etiology of cholera have since adopted in their investigations, and the result has been a general confirmation of Koch's views by all Western schools, hostile and friendly. Among the numerous investigators may be mentioned Cornil and Babes in Paris, Van Ermengen in Marseilles and in Spain, Nicati and Rietsch in Marseilles, Watson Cheyne and Doyen in Paris, Schotclius, Simone in Palermo, Canistrini and Marpurgo in Padua, Tizzoni and Cattani in Bologna, Lustig in Trieste, Ssawtschenko in Kieff, Wiltschur in St. Petersburg, Weisser and Frank, Macleod and Milles in China, Karlinski and many others. The results have not been obtained easily or without opposition. At the beginning there were many sceptics, but in almost all cases further investigation convinced the most sceptical of the reality of the discovery. Among the most distinguished of these may be mentioned Pettenkoffer, Emerich and apparently Dr. Klein. Only a few have remained undecided, namely, Loesch, Lesage Macaigne and Cunningham. Of these the first three think that cholera can be partly produced by a comma bacillus and partly by other microbes, while the last thinks that cholera is produced by some unknown extraneous cause plus comma bacilli.

The more perfect the methods which have been adopted the more frequently is the comma bacillus detected. Thus in the most recent epidemics observers have found the comma bacillus in 100 per cent. of cases or missed them in a very small number. Thus Karlinsky, on a scientific mission in Arabia, out of 293 patients found the comma bacillus in 288, only missing the microbe in five cases, and Wiltschur in the cholera hospital in St. Petersburgh found them in 70 cases out of 70.

Parallel with these investigations researches have also been made on healthy people, and as a general result no commas have been discovered. In isolated cases, however, they have been found in healthy persons suffering from slight diarrhœa or in healthy and apparently resistant persons exposed to cholera infection. Thus during the last epidemic in Hamburgh, apart from cholera patients, comma bacilli were found in 19 persons, out of which ten had suffered from diarrhœa for several days, six from diarrhœa of one day without any general disturbance, and three had no disorder whatever. Almost all these people were ascertained to have been closely associated with cholera patients. In man commas have been found so rarely under conditions not connected with cholera that they have no bearing on the subject of the causation of cholera. In this category may be placed the comma found by Lewis on one occasion in his own mouth which may possibly have been a degenerated cholera comma. These observations, with experiments which followed, tend to one conclusion, that the commas are the causal agents of cholera.

In the last epidemic in Europe attention having been paid to the examination of waters, a number of micro-organisms were discovered which, from their resemblance to commas, led investigators to test them by the standards which had been adopted for the diagnosis of cholera commas, with the result that, whilst some corresponded to these standards, others presented important differences. Thus Mendoza in Spain discovered commas in nine waters where suspicious cases of diarrhœa had occurred; Max Bleisch in Kosel, Gunter in the River Spree, discovered commas which liquefied gelatine, but were not pathogenic to animals. Foker discovered comma bacilli in a Dutch harbour which was suspected to be infected with cholera; the bacilli resembled cholera bacilli in every respect, except being pathogenic to animals. Foker supposed them to be degenerated comma bacilli; Fraenkel discovered comma bacilli with all the features of cholera bacilli in river water near a ship with a cholera patient; Orloff found comma bacilli in a well in Lublin, around which many cases of cholera had occurred; Bujwid found a comma resembling Koch's in river water. Neither Orloff nor Bujwid would give any opinion as to the nature of these commas. Weibel in Munich found commas in the water of a well, which a long time previously had been infected with commas; they differed from cholera commas only in their mode of liquefaction of a stab culture, and in other unimportant details; yet Weibel does not recognise them as cholera commas; Neisser in Berlin in the water of the Spree, which was contaminated with cholera dejecta, found a comma giving the indol reaction, but liquefying gelatine very slowly; he did not rank it as a cholera comma, although it seems to have been more pathogenic to animals than Koch's; he named it Vibrio Berolinensis. Heider found a comma in the water of the Danube canal in a locality where cholera occurred the next day; he also was unable to decide whether it was a cholera comma. Kutcher investigated eight commas isolated from the waters in Hamburgh, and of these seven were phosphorescent—a property which he considered to differentiate them from cholera commas. Sanarelli detected thirty-two commas in the Seine and Marne, only four of which gave the indol reaction, and four of them were pathogenic to animals; these and the others, though differing in form and character, he considered to be cholera commas. In Stettin a comma was isolated from water, which was recognised in Koch's Institute as a cholera comma. Gunter found in the soil in Koch's Institute a comma which did not liquefy gelatine, nor give the indol reaction, nor act pathogenically on animals, nor did it coagulate milk, nor grow well at 37° C. but its morphological appearance and its growth on agaragar and bouillon were the same as a cholera comma. He called it the Vibrio Terrigenus. Bonhoff examined in Koch's laboratory water from Stolp in Pomerania and found two commas, one liquefying gelatine but not giving the indol reaction, the other giving the indol reaction and not liquefying gelatine. Russell in Naples found in sea water a comma which he called Spirillum Marinum, which rapidly liquefied gelatine. Renan in Paris isolated from a specimen of water a comma which rapidly liquefied gelatine but was not pathogenic. Löeffler found in river water a comma which liquefied gelatine very rapidly like Finckler-Prior's comma. Blackstein found commas in Seine water, and distinguished them from cholera commas by the opaque appearance of the cultures. Fischer found a number of vibrios in sea water which differed from cholera, chiefly in their preference for sea water. Pfuhl found in the waters of Berlin a comma, which by the manner in which it liquefied gelatine, and its pathogenic powers on pigeons, he took to be Metchinkoff's comma.

Sprong of Utrecht investigated eleven commas from waters in Holland, and compared them in fifteen different respects with cholera commas isolated from patients living in the same localities, but such is the position of the question at the present time that even when he found many of the water commas corresponding in nearly every respect to the cholera commas, he hesitated to pronounce these water commas to be the same as the cholera commas. Dunbar likewise in observations on the waters of the Rhine in different places found comma bacilli resembling in every feature those of cholera bacilli and which disappeared contemporaneously with the cessation of cholera prevalence. Kutcher, however, on a later investigation of these commas, found a number to be phosphorescent, and owing to this property Kutcher believed them to be not cholera commas, because up to that time phosphorescence had never been observed in cholera commas.

With regard to the differences referred to in the water commas, it should be noted that the experience of the laboratory shows in the course of the culture of one and the same specimen of comma bacilli constant modifications which would indicate that the comma bacillus when cultivated in nature will be found presenting under different conditions similar, or even greater, modifications. As a matter of fact D. D. Cunningham found in typical cholera patients a variety of commas, which induced him to classify them into several species. Similar observations have been made in European epidemics, and have for a long time past given rise to and strengthened the opinion that the early characteristics ascribed to the comma bacilli, when first studied, are not of a fixed nature, nor are even those characteristics which have been given to them afterwards. Thus it happens that in a true cholera patient commas are found which do not liquefy gelatine, nor give the indol reaction, nor have a pathogenic effect on animals, and in cholera cases commas have even been discovered with phosphorescent properties

It is accordingly seen that similar differences exist in commas with an unquestionable cholera origin, as between commas that have been hitherto found in water, and the question arises whether all the commas found in waters cannot be considered as cholera commas. Sprong, Dunbar, Dahmen, Sanarelli hinted at such a possibility, but evidently the proofs were wanting. We propose to add some facts regarding commas in nature from this point of view. In April 1894, when cholera was at its height in Calcutta, an investigation was undertaken by us to ascertain the distribution of comma bacilli in Calcutta, especially in waters. For this purpose 582 specimens were collected in 211 localities and examined. Of the 211 localities, 110 were from tanks, 15 from private wells inside houses, 26 from drains, 12 from the river Hooghly, 4 from canals, 4 from bathing platforms, 24 from street hydrants, and 24 from milk markets and vendors, 4 of food and 4 of air in infected houses. Of the 582 specimens, no fewer than 432 were of tank waters. The tanks or ponds form a special feature in the physical topography of Calcutta. Originally excavated to raise the surrounding land, in order that huts and houses might be built on the raised land, the tanks became useful, first, as reservoirs of rain water for supplying the neighborhood, or cluster of huts, with water for drinking and for domestic purposes; and, secondly, as a convenient receptacle into which the drainage of the locality should flow. Different districts differ in the number of ponds which they contain; some are honeycombed with these tanks, and during the rainy season there is actually in some areas more water than land, others have fewer tanks, and a number of them are protected from pollution by drainage. The public tanks are also, as a general rule, well looked after; but the majority of tanks are the mere drainage cesspools of the locality. Much has been said regarding the filthiness of these ponds. They more or less resemble pea-soup in colour, and their composition has been officially reported as concentrated London sewage. The drainage from latrines often find an easy and convenient outlet into their waters, soiled clothes of the sick and of the healthy are washed therein, men, women and children bathe and perform their ablutions in the pond, while oxen, buffaloes, horses, goats and other animals are taken down to the water's edge and there given a bath. In such water the inhabitants cleanse their utensils and soak, macerate and wash their rice and dahl, and not infrequently prepare other kinds of food. No analysis is needed to determine the unsuitability of the tanks for use for domestic purposes, because the color of the water and its smell are sufficient to condemn its purity.

It is to the tanks that for years past localised outbreaks of cholera have been traced. So frequently has this happened that now whenever a localised outbreak occurs the routine practice is to place a policeman at the tank to prevent the inhabitants drinking the water.

Of the 110 tanks examined, 46 were tanks around which cholera existed at the time of the investigation; 5 were tanks around which cholera had existed a month to six weeks previously and had disappeared, and 59 were tanks around which cholera had not appeared during the four months of 1894. The result of examination was as follows: Out of 46 tanks around which cholera existed commas were found in 42, *i.e.*, in 91·3 per cent.; out of 5 tanks where cholera had disappeared a month to six weeks previously commas were found in none. Out of 59 tanks around which cholera had not appeared commas were found in 11, *i.e.*, in 18·8 per cent., and were not found in 44, *i.e.*, in 81·4 per cent. Of the wells in the interior of houses 6 were in houses in which there was no cholera and 9 in houses with cholera. Of the 15 wells examined commas were found in only one in a cholera house.

In the water from 24 street hydrants, 9 of which were in cholera localities, no commas were found. In water taken directly from the river Hooghly of 11 localities commencing from Pultah at the intake of the Calcutta water-supply, and terminating at Howrah Bridge just above the Port of Calcutta, no commas were found. We were unable to ascertain about the existence, or not, of any cholera cases in these localities. Later in the year commas were found in the unfiltered water of a house supplied from the river a little below the Howrah Bridge. The supply was pumped from the river and delivered by a pipe to the house. In this house an outbreak of cholera had occurred which was the reason for examining the filtered and unfiltered water on the premises.

The water of the Chitpore Canal which was used for drinking purposes was also examined at a time when cholera broke out among the inhabitants residing on its banks. Commas were found in 5 specimens out of 18. The examination was made on the day on which the canal water was changed; 13 specimens taken near the lochs were negative, while 5 a little further away were positive.

In another canal near which no cholera existed, and in an isolated locality, commas were found.

Of 23 samples of milk, 4 of which were taken in cholera localities and 19 were bought in markets and from vendors in the street, one of the former and one of the latter contained commas; of products of milk 8 samples of curd water were examined and in none were commas found.

We examined food on only four occasions. In three there were no commas, in one we found commas under the following circumstances:—

In a flour shop a man was pointed out to us as being attacked with diarrhœa. On examining him we ascertained that he had washed his soiled clothes in a tank behind the shop, and we discovered the clothes still wet lying on a part of the flour exposed for sale. We took possession of the flour, and in the laboratory obtained from it a culture of comma bacilli.

Air in infected houses was examined on four occasions, once in a room where two people died of cholera and in which one of the bodies was still unremoved. The floor of the hut had been soiled with excreta. In the air passed through peptone for two hours no commas were found.

Twenty-six open surface drains of the street were examined, 10 of which were in localities with no cholera and 16 in localities with cholera. In the drains in non-choleraic localities, 5 drains were found infected with commas, and in the choleraic localities 5 drains were also found infected with commas. In one of these cases commas were found in an extremely large proportion in the water and rice in an open drain on the second floor of a house in which the last case of cholera had died a fortnight previously.

The result of these investigations seems to narrow down the relationship between commas in tank water and cholera, whilst no distinct relationship of this kind could be discerned in the other objects examined. If the commas be admitted to be the cause of cholera in man, such a result is easily understood. It is unlikely that the microbes in drains could gain a direct access to man and reach him without the assistance of food or drink. The relationship, moreover, between hydrant water and cholera is excluded in Calcutta by the excellent arrangements for purification and filtration, and it is our belief, as matters stand, no case of cholera is produced in Calcutta by the Municipal filtered water. On the other hand the inhabitants around the tanks have a most intimate connection with the waters. They bathe, wash their clothes, cleanse their mouths and frequently drink the water and clean their domestic utensils in the tank.

But even in the tanks examined we did not find commas present with an absolute regularity. In 9 per cent. of those in which cholera existed, we failed to find them, and in 18 per cent., where cholera did not exist, they were discovered. Notwithstanding these exceptions the results appear to us to be one of the strongest confirmation of the direct relationship between the comma bacilli and cholera. The 9 per cent. on the one hand and the 18 per cent. on the other seem to us to be within the limits of error as attached to the examination of large tanks, which are subject to all the condition of their open and exposed nature. These results seem to be more demonstrative, as they correspond in some degree to the slight variations in the results of investigations in men. In a small proportion comma bacilli are missed in cholera patients, owing to defects in technique, while in a small proportion of men in whom they are found, they fail to produce serious disturbance owing probably to the resisting power of the infected individual.

The method of the present investigation runs parallel to that of Koch's, which ten years ago started the lines of research adopted since by all bacteriologists in cholera, and which concentrated attention on the presence or absence of comma bacilli in choleraic and non-choleraic men. Having before us the advantage of a definite microbe, and the further advantage of the improved methods for the detection of the comma bacillus, we made our researches on the presence or absence of this microbe in choleraic and non-choleraic localities in nature; not only is the method parallel, but the results obtained by it conform to those obtained otherwise.

The special question which this paper refers to is the following: In the beginning of our paper we quoted the great difficulties of distinguishing one comma supposed to be a cholera comma from another comma supposed to be saprophytic and non-choleraic owing to their great racial variations; the result of our paper seems to us to show that in nature there appears to be no water commas, except those connected with cholera varying as we found them in their morphological and physiological and biological characters.

Before concluding this paper we take advantage of the opportunity of stating that in examining cows affected with diarrhœa, in different parts of Calcutta and Howrah, and in examining cesspools connected with cowsheds, in which cows had been ill, we found commas in the cows and in the cesspools. The results of further investigation on this subject we hope to be able to communicate on a future occasion.

ANTICHOLERAIC INOCULATIONS IN INDIA.

BY W. M. HAFFKINE.

The object of the present paper is to give a brief sketch of the work which I have done in India during 1893 and 1894.

Ten years have elapsed since this city was visited by Robert Koch for the purpose of investigating the causes of cholera. The researches, which have since then been carried out in various parts of the world and under most different conditions, all tend to confirm his original results. In spite of the most careful researches, no other microbe has been found besides the *comma bacillus*, that is constantly associated with the disease, and is not to be found in any other circumstances.

Cholera, as a natural disease, is not known among animals. Even man in an average state of health exhibits a high degree of resistance to this disease, although the differences observed in this respect in a number of individuals are very great. In correspondence with these facts, it has been shown that animals do not become affected by the comma bacilli in a way recalling the symptoms of cholera, and that an artificial infection tried on healthy men remains in a very large proportion of cases without effect. The toxic power of the comma bacilli can, however, be shown in many ways. In the majority of domestic and other animals, when introduced in their abdominal cavity, often in minimal quantities, the comma bacilli produce a fatal effect. The same result is observed when the cholera microbe is injected into the depth of the muscular tissue. Its introduction into the circulatory system is accompanied by important disturbances of health, which may be fatal.

But the disease thus produced in animals does not present the symptoms peculiar to cholera, and when given *per os*, and thus introduced into the alimentary tract, the comma bacilli remain without effect.

It is easy to show that, by preventive treatment with attenuated cholera virus, the animals can be protected against all those forms of artificial infection, which otherwise would be fatal to them. Ferran in Spain, in 1885, experimenting on very young guinea-pigs, which used to succumb to a hypodermic inoculation, has shown the protection with regard to this form of infection. In 1892, Brieger, Kitasato, and Wassermann, and myself have shown an immunization against peritoneal inoculation. I have demonstrated that animals can also be protected against the infection in the muscular tissue. A number of investigators have repeated these experiments with the same results, and on different species of animals.

But the chief question, whether it is possible to protect man against the particular form of disease to which he is subject, cannot be solved by these experiments beyond a certain degree of probability.

On the other hand, the infection of the *intestinal tract* of lower animals by the comma bacilli can be produced only under circumstances which tend to obscure the results and make the conclusions drawn from them uncertain. The usual method adopted for this kind of infection, since the experiments of Koch, consists in the introduction into the stomach of a 5 per cent. solution of carbonate of soda and of the injection into the peritoneum of an alcoholic solution of opium in the proportions of 1 gram of the tincture to 300 grams of the weight of the animal. The dose of the microbe is then introduced by a sound into the stomach.

The first of these three processes, the injection of soda, is intended, by neutralizing the contents of the stomach, to prepare a free passage for the comma bacilli, which else would be killed by the gastric acids. But by this neutralization of the acids the natural disinfection of the stomach is stopped, and in a few hours this organ is found to be swarming with a multitude of microbes, which penetrate into the intestine at the same time as the comma bacillus. The consequences of this is that the ingestion of soda by itself, without the two other operations, in a large number of cases, disturbs the health of the animal.

The second part of the operation, the injection of opium into the peritoneum, has for its object the stoppage of the peristaltic movements of the intestines, thus to facilitate the act of infection. This preparation is often fatal to the animal. Without the subsequent infection with the comma bacilli, animals thus treated with soda and opium succumb in a large proportion of cases.

Lastly, the third part of the procedure, the introduction of the comma bacilli, when taken *per se*, is absolutely harmless to the animal.

Thus, in this combination of three different processes which are employed to produce an imitation of cholera in animals, the last one, the process which is to be studied, is the one which has the smallest effect, and is easily obscured by the two others.

When two groups of animals, one subject to some protective treatment by cholera virus, the other not, are exposed to this combined operation, both groups are equally affected by the first two processes, and it becomes difficult to discern the difference in the action on them of the last process. The administration of opium must be done with great care, and a third control set of animals must be taken for comparison, which are treated with soda and opium alone. The difference between the protected animals and the unprotected can then be easily put in evidence. As to whether inoculation is protective under these conditions, contradictory results have been obtained. Brieger, Kitasato and Wassermann, Klemperer and myself have succeeded in obtaining animals protected against the intestinal form of infection, whereas Pfeiffer and Wassermann, Sobernheim, Zabolotny have only obtained negative results.

The method which has been applied lately by Mons. Metchnikoff for the intestinal infection of very young rabbits, and which consists in an admixture with the comma bacillus of two other microbes, has not got over the difficulty. The two auxiliary microbes are supposed to increase the effect of the comma bacillus; but this in its turn reacts on the two microbes. Both groups being equally harmless by themselves, it is impossible to decide whether illness or death of the animal is produced by the comma bacilli, or by the two other microbes.

The laboratory experiments on men are attended with still greater difficulties. Judging by the observation hitherto made on cholera, it is to be expected that, if an attempt had been made on a hundred men to infect them with cholera by ordinary cholera vibrios, not more than five, or ten, or, in the most favourable conditions, twenty of them would show symptoms of the disease, and in about half of this number the experiment would prove fatal.

Attempts have, however, been made in Germany, France and Austria to facilitate the experiment on man by producing artificial gastric disorder preliminary to the infection by comma bacilli. I need not say that these attempts have been made by the investigators, first of all, on their own persons and, afterwards, on people who offered themselves voluntarily and with full knowledge of the danger they were undergoing. The result showed great individual differences in regard to the susceptibility to the disorders produced by the preliminary operations and by the infection. A disease, though mild, resembling in all main features cholera, has been produced in only one case, which occurred in the group of experiments carried out by Mons. Metchnikoff. In a certain proportion of cases the experiment resulted in a more or less persistent attack of diarrhœa, and others remained unaffected.

At this rate, for producing in the laboratory ten or twenty cases of cholera, in order to try on them any preventive or curative treatment, a trial must be made at an infection of two or three hundred individuals, with a strong infective virus.

The method which I adopted was to attempt not to infect, but to save, during an epidemic or on the approach of such, a certain number of individuals, basing my actions on the exact knowledge which could be obtained from laboratory experience; and by comparing the fate of the treated individuals with that of the non-treated, to draw the final conclusion as to the effect of the treatment.

An attempt of a similar kind has been already made in Spain during the epidemic of 1885, by Dr. Ferran. As has previously been mentioned, this observer noticed that young guinea-pigs, inoculated under the skin with a certain dose of cholera virus, succumbed, whereas, when previously injected with smaller and tolerated doses, they became able to stand otherwise fatal hypodermic injections. He accordingly made cultures of cholera microbes in liquid medium, and applied these for injections in man.

The results of these operations were never clearly ascertained. The account of Dr. Shakespeare, the American investigator, is highly commendatory as to the effect of the treatment. The delegates of the French, Russian and some other European Governments returned back bringing with them unfavourable accounts. A study of the numerous data, published by Ferran since, failed to produce conviction in the efficacy of the treatment employed by him, and the whole question remained open.

In Ferran's procedure must be recognized a source of uncertainty, which tended, first, to vitiate the results, and, secondly, to render the method inapplicable as a general measure. This source of uncertainty was the employment for purposes of treatment of a virus taken directly from a diseased subject. Microbial virus in nature is extremely variable in its properties and in its pathogenic strength. This rule is especially applicable to those forms of virus, which are capable of growing outside the animal body, and, in a still higher degree, which, like the present, are incapable of protecting themselves by the formation of spores. A comma bacillus may be fatal to a guinea-pig when injected into the peritoneum in the dose of one-hundredth of a culture, while another will be harmless when used in a dose five hundred times larger than this. Whereas the ordinary comma bacillus is without effect when injected under the skin of an adult guinea-pig, others are to be met with, which will kill under these conditions when used in minimal doses. The comma bacillus, as a rule, is without effect on pigeons (and on birds generally); but, during the epidemic in Massouah in 1890, and during the last years in Europe, several specimens have been isolated, fatal to these birds. On the other hand, one and the same specimen, when cultivated in the laboratory for any length of time, undergoes considerable alterations in its power. Mons. Metchnikoff quotes the example of a comma bacillus isolated in France, which gradually diminished in power to about 1-75th of its primitive strength. It is evident, therefore, that a virus, taken from a diseased organism, varies from being a very dangerous one to one which will be without any effect on the most susceptible individual.

The use of virus of such origin for purposes of treatment has now been finally condemned in the case of small-pox. The discovery of a method of cultivating and keeping of a lymph of a well determined degree of virulence constitutes the work done by Jenner at the end of the last century. The researches of Pasteur have elucidated the principles of the transformation of virus, and a problem similar to that of Jenner has been solved by him in regard to three diseases of animals (chicken-cholera, anthrax and pig-measles) and one disease common to animals and man, namely hydrophobia.

To Gamaleia belongs the credit of having made the first attempt to find out a means of fixing the strength of the cholera virus. The method which he applied was based on the procedure employed by Koch for producing intestinal infection in guinea-pigs, with the help of carbonate of soda and of opium. The inadequacy of this method depends on the fact that the intestinal canal is populated by a flora and fauna of other organisms, and on the impossibility of breeding there a virus in a pure culture. The result of the introduction of a virus into a medium, occupied by other microbes, depends on the nature of the latter, and since the microbial population in the stomach and intestines of animals is constantly varying, a regular cultivation of the comma bacillus in the digestive tract for the purposes of a regular modification of its qualities is impossible.

The method that I worked out for transforming the cholera virus into a vaccine of a fixed nature is based on the cultivation of the cholera bacilli in the peritoneal cavity of guinea-pigs. The rules which it is necessary to observe in order to obtain an uninterrupted series of passages, from animal to animal, the modification gradually produced in the virus by these procedures, the attenuation of this vaccin in order to deprive it of its necrotising properties, and to transform it into a mild first vaccin, have been described originally in the "Comptes Rendus des Séances de la Société de Biologie de Paris," and in different English Medical Journals, and need not be referred to here. It suffices to say that the two modified races of cholera virus, which I obtained, have put in our hands a means of protecting animals with certainty, and in an absolutely safe manner, against all forms of infection by the cholera virus fatal to them; and the problem then had to be approached of putting to the test these vaccins, the harmlessness of which for man has been proved first of all on myself and on all people connected with my laboratory. Cholera has visited Europe several times since the year 1832, and on each visit has produced great ravages in the populations of the West; but it is not a disease endemic in that part of the world, and it re-appears there only after very long intervals. It was in the home of cholera, in the delta of the Ganges, that a trial of preventive inoculations for that disease had to be made.

For those who, in Europe or in any other places, will judge my work from the point of view of a laboratory research, and will discuss the most convenient conditions for getting precise answers to theoretical questions, I must say from the beginning that I was not, and am not, master of the plan of my operations. A country and a free population, and the various influences and currents of opinions intervening, and religious feelings, and traditions, and the mixture of confidence and distrust on the part of individuals and communities are conditions differing from that in which a quietly elaborated plan of operations is put to test in the walls of a laboratory or on an experimental field of cultivation, or in other similar conditions.

The first problem, which I had to solve, was to find out whether the inoculations generally could be applied in India, and whether it was possible to induce masses of inhabitants to undergo the treatment in large bodies of people, as it was necessary for my work. Those who know the East and the conditions in the Eastern populations, and who have been present at my first efforts, do not require to be reminded of the difficulties which attended this task. It is clear that the choice of best conditions, or of any conditions whatever, was out of question for me. It required a year's persistent work, and inoculation of many thousands of volunteers in distant points of the N.-W. P. and Oudh and of the Punjab, in all classes of population, before I became able to direct my work to such points of the country and to such classes, where the conditions answered the scientific requirements of the problem.

I could not carry with me a laboratory. It was most fortunate for my work that a short time before my arrival in India the Government of the N.-W. P. and Oudh decided to found a bacteriological establishment in that part of the country and entrusted it to the able direction of Professor E. H. Hankin. He and his laboratory were of the greatest help to me during the whole time of my work in the upper part of India. But great as was this assistance, it was far from being sufficient. I mentioned already the great variations which the cholera virus undergoes when cultivated in the laboratory. For keeping it at the required state, it is necessary to pass it constantly through animals in the same way as a vaccine lymph must be always taken fresh from a calf or a child, if one wants to have it at its full power. It is sufficient to say that, when I came from Calcutta to Agra for the first time, I was able to procure and to bring with me only six of the required animals. The most essential part of my method, which forms its distinguishing feature, could be carried out during the whole time of my nomadic operations in the country, in a most unsatisfactory manner.

It must not be forgotten that, from the commencement, I announced that the protection which I hoped to obtain was not yet established as certain, and the operations, which I was about to perform, constituted an attempt or trial in that direction. I could only offer the possibility of protection and an assurance of harmlessness, an offer which could not be a great inducement for many to subject themselves to discomfort and temporary illness and loss of time connected with the operation. Before the first observations have been made in a cholera place and the fear of the operation dissipated, I was obliged to content myself with inoculations producing only slight effect, a low degree of fever, and which in many cases left the subjects without any marked reaction at all. In the experimental inoculations which had been done in Europe, in France and England, a dose of $\frac{1}{8}$ of a culture tube has been used for each adult person. In the first inoculations in Agra I reduced the dose to only $\frac{2}{3}$ of that amount, *i.e.*, to $\frac{1}{12}$ of a tube. Two accidents, which in themselves had nothing to do with the operation, attended the first inoculations, and the whole operation being unknown to the public and easily impressing the minds, I had to reduce the dose further to 1-20 of a tube. The necessity of using weak doses has been still more impressed on me when I arrived at Delhi, where I could start the inoculations exclusively on condition of using reduced doses of vaccines.

The agreement of the people and their consent to undergo a new and unknown operation were the only circumstances which guided me in the determination of the doses. In the absence of any information on the adequacy or inadequacy of these doses, and in the necessity to conform to circumstances, or to abandon my problem altogether, without any prospect of its being done in better circumstances, I chose finally the first alternative.

The inoculations have been done in chronological order in Agra, Aligarh, Jhansi, Lucknow, Tanawar, Kasauli, Dagshai, Delhi, Patiala, Simla (and Yatogh), Rajpurah, Sangrur, Rawal-Pindi, Murree, Peshawar, Chirat, Nowshera, Naini Tal, Almora, Ranikhet, Dworahat, Kainur, Sakniana, Musagali, Paori, Shrinagur, Tehri, Musooree, Dehra Dun, Hardwar, and Jawalapur, Sakrampur, Lahore, and Mian Mir, Sialkot and Kansi Village, Pasrur, Seranwali, Amritsar, Kapurthala, Wazirabad, Dharmsala and Gujerat. In some other places inoculations have been done by those who studied the necessary technique.

The number of individuals inoculated up-country was 22,603. Of these 8,473 have been done in the N. W. P. and Oudh and 14,130 in the Punjab. With the 9,563 inoculated since then in Bengal, Behar and Assam, the total number of inoculated up to now is 32,166. The town where the largest number have been inoculated was Patiala. About two-thirds of the total number have been re-inoculated with the second vaccine from five days to two months after the first, bringing thus the number of performed operations to a little below 50,000.

Of each man inoculated a record has been kept giving the name, age, sex, religion and caste, birthplace, profession, address, remarks on health and previous attacks of cholera, the date of first inoculation and the date and dose of second inoculation. In case of soldiers the fact of inoculation has been entered in the medical history sheet; in case of people in prison—in their jail ticket. The principals of schools kept a list of the inoculated children (the inoculation, in case of minors, have always been done exclusively with the consent or desire of their guardians.) Many Civil Surgeons preserved in their offices a record of the inoculated civil inhabitants; to others such a record will be sent. In this manner observations have been made possible in the future in different parts of the country at the time of cholera outbreaks.

During the year of 1893 two outbreaks of cholera, both insignificant, came to my knowledge in Upper India, where I was working. One was in villages near Sahrampur, another in villages near Gujranwalah. Immediately after having heard of these outbreaks, the local authorities have been asked whether it will be possible to apply the inoculations in the affected places. On both occasions the answer was a negative one. Towards the end of 1893 another attempt was made through the authorities in a station of the E. B. S. R., which had been attacked by cholera. The answer this time was negative also. On different occasions, when large numbers of people had been already inoculated in different places, I made enquiries in Calcutta, whether inoculations could be applied there, but the result was invariably negative, and it was believed that the people here being more educated, but also more timid than in other parts of India, the difficulties for my operations would be particularly great. In the beginning of 1894 Surgeon-Major Lewtas, then Civil Surgeon in Chittagong, wrote to me in Amritsar, saying that a certain number of Europeans in his station expressed the desire to be inoculated against cholera, and asked me to send him vaccines, the use of which he had learned during my operations in Simla. As Chittagong lies in the endemic area of cholera, I availed myself of the opportunity of asking Dr. Lewtas to help me to introduce the inoculations in a large scale in that town. Dr. Lewtas did everything in his power to prepare for me this result. I started for Chittagong immediately.

But in my passage through Calcutta a small outbreak of cholera occurred round a tank, in a suburb of that city. Dr. W. J. Simpson, the Health Officer, asked me to investigate with him the water of that tank and to arrange experiments for the detection of the cholera microbes. Cholera microbes, indeed, were detected in this water, and at the same time we discovered the possibility of applying the inoculations in the affected huts of the bustee, at the height of the cholera season. On the 11th of March 1894, preventive inoculations were done for the first time in India in a place where cholera existed, one year and six days after I landed in this country. In the course of about a month, with the aid of that excellent arrangement of Indian Medical Inspectors of the Health Office of Calcutta, we had about a thousand people inoculated in the most affected parts of the metropolis, and the first observations were not long in forthcoming.

The question which has always been most difficult to answer was, how I could collect my observations, and, when collected, what possible conclusion could be drawn from them. In a city like Calcutta, with over 800,000 inhabitants, was I to inoculate half of the population for the purpose of comparing inoculated with non-inoculated and of testing my method?

For a long time in different parts of India I was asked this question with an air of absolute scepticism. It was, indeed, impossible for me to inoculate whole cities. Besides, the intellectual part of the population almost does not suffer from cholera at all, and the part which chiefly suffers from it is exclusively composed of classes whose fate cannot be traced afterwards, who move constantly from place to place and are soon lost sight of. Outbreaks among the troops or in jails are, indeed, very rare. In all Bengal and Madras Central Jails during the last ten years, the mortality from cholera was practically nil. It is impossible to know even with an approximate degree of probability the part of the country where any considerable outbreak might occur, and at the time when cholera does break out, it is useless to attempt to get to the place, for applying any preventive method, cholera making its ravages very rapidly and disappearing as suddenly as it appeared.

I must confess that this unanimous verdict on my proposed work made on me a deeply painful impression. I must say that when I undertook this work, I had not an adequate idea of the difficulties which were in store for me, great as were those which I was ready to face.

I was mistaken, while in Europe, as regards the facts relating to the distribution of cholera in India. And those who were more familiar than I was with the conditions of this country, it is strange to say, did not notice for a moment my mistake. I thought it possible to select in India a village or a small town, of three or four thousand inhabitants, which suffer regularly from a well known amount of cholera; by inoculating, before the cholera season, a half or a large portion of this single village, in this way, a field would be prepared for observing, in the course of one year, two epidemics of cholera, of perhaps a couple of hundred cases each, and for judging of the effect of my operation. How different were the difficulties connected with such a project from those which actually awaited me!

The problem was solved in a way which revealed itself only after a long period of work. It was not necessary to inoculate half a country or a city, or even half a village. In the endemic area each house can comprise within its wall an experimental group. By inoculating a certain number of these houses, selected in affected quarters, there is the probability of cholera appearing in some of them and allowing of comparisons between the inoculated and not inoculated members of the house, who otherwise are under similar conditions of food, water, soil, social customs, etc.

As regards inoculations in areas where cholera did not exist, where I had to work during my first year of operation, I had to decide upon spreading the inoculation in as many localities and regiments as possible, leaving to epidemiological laws the selection of locality where the result of my work could be later on observed. The first method gave results in Calcutta, the second in Lucknow and Cawnpore.

A third method was adopted in Gaya Jail where, on the appearance of an outbreak, measures were taken to apply the preventive treatment at once and to take advantage of the later part of the epidemic.

In Calcutta inoculations have been carried out from the beginning of March of this year till the present time; 3,478 persons have submitted themselves to inoculation. In 13 houses cholera appeared from 2 to 180 days after the inoculations have been carried out. The total number of the inhabitants of these houses was 181. Out of this number 85 were inoculated, 96 untreated. The number of cases of cholera that occurred among the 85 inoculated is 1, which was followed by a fatal issue, giving a percentage of attacks and deaths of 1·18 per cent. The number of attacks among the 96 non-inoculated was 15, and of deaths 11, giving a percentage of cases 15·63 per cent. and of deaths total 11·63 per cent. The case of a child in a cholera bustee, who was suffering from diarrhœa at the time of inoculation and developed typical cholera within an hour of the treatment, is not included in the above statistics.

Of soldiers who had been inoculated by Mr. Hankin in Cawnpore thirteen months previously, 75 were present on the occasion of the epidemic of last August, and were located in barracks with 177 non-inoculated. During the epidemic 19 cases of cholera and 13 deaths occurred among the non-inoculated. No cases occurred among those who had been treated.

In Gaya Jail I arrived on the 18th July of this year, at a time when cholera had already broken out, and six cases and five deaths had occurred. During the epidemic which lasted a fortnight longer, on an average 409 were present. Of these 207 were inoculated and 202 remained without treatment. Among the non-inoculated 20 cases of cholera appeared with 10 deaths. The inoculated presented eight cases, and of these five led to a fatal issue. The distribution of cases among both groups is to be seen in detail in the following table :—

During the first five days after inoculation :—		
Not inoculated	7 cases with	5 deaths.
Inoculated	5 ,,	4 ,,
During the next three days :—		
Not inoculated	5 cases	3 deaths.
Inoculated	3 ,,	1 ,,
The last six days :—		
Not inoculated	8 cases	2 deaths.
Inoculated	Nil.	Nil.

It will be observed from this table that the difference in figures increased gradually until the eighth day.

This difference was nil on the first days after the inoculations were carried out; and it is seen to have increased gradually till the eighth day after the first day of treatment. A similar phenomenon has been observed in vaccination against small pox.

I am of opinion that in a milder epidemic the protective influence would show itself in a more marked manner also in the first few days after inoculation. I base this opinion on the well ascertained results of laboratory experiment.

Whereas in Gaya the treatment was applied during the epidemic, in Lucknow the epidemic occurred 14 to 15 months after the inoculations. The results were as follows:—

	Cases.	Deaths.
640 Non-inoculated	120	79
133 Inoculated	18	13

	Pcge. of cases to strength.	Pcge. of deaths to strength.
Non-inoculated	18·75 per cent.	12·34 per cent.
Inoculated	13·53 „	9·77 „

With regard to all these results three possible points of view can be taken up.

Firstly, that the fact of the protection of animals against all forms of the cholera virus is of no significance whatever; that the Calcutta results are a mere coincidence; those in Gaya also a coincidence; the differences in the occurrences among the inoculated and non-inoculated in Lucknow are equally accidental, and only those, who died in the latter locality, can be quoted as bearing on the subject and completely condemning the method.

Secondly, another point of view is that the fact of the immunization of animals proves that a living organism is capable of being protected against the cholera virus; that the Calcutta results are quite comprehensible in this light; that the Gaya results are of a similar nature; that the difference in the fates of the inoculated and non-inoculated in Lucknow is also an illustration of the above law, and that the cases of failure are due to the lapse of time and the vanishing of the effect of inoculation, which could not be determined beforehand.

Thirdly, the following view may be held: The first four facts are proofs of the value of the inoculation, and the cases of failure in Lucknow are due to both the lapse of time that occurred since the carrying out of the inoculations, and the feeble reaction produced on the subjects on the time of the treatment. Indeed, as is recorded in the Lucknow registers, out of the 185 men inoculated in the East Lancashire Regiment 66 showed no fever after the inoculation, 70 had only a slight rise of temperature, and in only two out of the whole number was the febrile reaction well marked. (This result was due to the mildness of the virus employed and the relatively small doses in which it was injected.) It is a well established law that the amount of protection conferred, whether in small pox, anthrax or any other disease, is in direct relation to the amount of fever produced at time of the inoculation.

The number of observations is not sufficient, and the time is not ripe for discussion, nor for an attempt to bring about a general consensus of opinion. I intended to do everything in my power in order to obtain facts for deciding definitely between these three possibilities, a decision which in my opinion can only be brought about by an increased number of observations, and not by discussion.

I will point out, however, one fact, namely, that the harmlessness of the operations, whether in the presence or absence of cholera, is now definitely established. This is proved by the examination of the figures. Summarising the occurrences among the inoculated and uninoculated, and disregarding the question whether they were accidental or not, we have the following results: Total number of those on whom observations have been made in Calcutta, Gaya, Cawnpore and Lucknow is 2,235. Of these were inoculated 500 and 1,735 not inoculated.

Inoculated had 21 attacks and 19 died, giving a a percentage of cases to total of 4·2 and deaths to total 3·8 per cent.

Uninoculated had 174 attacks, and 113 died, giving a precentage of cases to total of 10·63 per cent. and deaths to total of 6·51 per cent.

These figures not only show that the inoculations are harmless, but show a difference in the occurrences that, if interpreted, can only be interpreted in favour of the inoculations.

In conclusion, I beg to express my thanks to all those who have so kindly helped me in carrying out this work. I appeal to Medical Officers and to others to give me further facilities for bringing a conclusion to this important question, by helping me in collecting observations and in spreading the inoculations in the most appropriated places for this.

DISCUSSION.

W. H. Gregg (Calcutta) related his personal experiences when inoculated in July last.

A. M. Davies (Meerut) said, referring to the addresses of the previous speakers and the authorities quoted therein, that the present position of the bacteriological question seemed to be that no comma bacilli existed in nature other than those connected with cholera. The comma bacilli found in water and elsewhere that did not show pathogenic properties had been always spoken of as *degraded* forms of the cholera microbe. The question arose whether some of these were not forms capable of acquiring virulence under conditions as yet unknown to us. Sanarelli had demonstrated that a virulent comma could be attenuated, so as to lose all its pathogenic power by keeping it in boiled lime water for a month, though morphologically it was unchanged. If a pathogenic microbe could thus be changed into a harmless saprophyte, why should not a saprophyte (under ordinary circumstances harmless) be changed by the circumstances of its environment into a pathogenic microbe? In other words, the process of *evolution* might reasonably be supposed to be at work, and the cholera microbe looked upon as susceptible of variation, both morphologically and in its cultivation characters, and pathogenic properties. The development of a progressive power of infectiousness was now held by many authorities in regard to diphtheria; the development of specific infective property had long been recognised in regard to dysentery; enteric fever outbreaks were often connected with previous diarrhœa prevalence, pointing also to an increase or development of the infective entity or thing. It had not hitherto been shown that any similar development took place in the case of cholera, but it might be that the connection held by many bacteriologists to exist in the case of enteric fever between the non-specific *Bacillus coli* and the specific *Bacillus typhi* might have its parallel in a connection between non-pathogenic comma bacilli and the veritable cholera microbe, in which case water or food containing such apparently harmless commas would be looked on as dangerous, in the same way as water or food containing *B. coli*, variations in surrounding circumstances being probably able to bring about a development, or evolution, of specific pathogenic properties.

R. Harvey (Calcutta) said he had one practical remark to make which was this, that while there could, he thought, be no doubt that Professor Haffkine's inoculations gave temporary protection, it remained to be seen whether the protection was permanent. The question was still in the experimental stage, and could only be settled by a continuation of the inoculations on a grand scale. He thought it was the duty of every medical man in India to give every facility for extending the experiments to such an extent as to furnish sufficient material to settle the question one way or the other.

L. Rogers (Lucknow) laid stress on the importance of tracing and disinfecting all evacuations of early cases with a view of checking outbreaks in a limited community, such as a regiment, and on removing the earthen floors of rooms in which patients had been. He asked if the incubation period might not sometimes be longer than seven days, the usually assigned limit, and mentioned two cases in which it had apparently been ten and twelve days. Referring to the recent success of antitoxin in the treatment of diphtheria, he suggested that a similar result might be obtained in cholera. He pointed out that M. Haffkine's experiments showed that a cholera antitoxin was developed in animals as the result of his injections. This and the Gya experiments led one to believe that at all events for a short time anti-cholera antitoxin was probably present in the recovered patient's blood. If so, he asked would it be allowable to use such blood obtained by venesection, or better serum obtained by blistering such a recently recovered patient, for inoculation into a patient actually suffering from cholera in the hopes that such an antitoxin might cut short the disease.

R. L. Dutt (Hughli), in support of the strong evidence produced by Dr. Simpson in favour of Koch's bacillus as the true cause of Asiatic cholera, adduced the latest experiments on the subject by Dr. MacLeod of Shanghai. Dr. MacLeod had succeeded in reproducing cholera in guinea-pigs by feeding them with a few drops of the pure culture of Koch's bacillus in broth under the precautions suggested by Koch, *viz.*, neutralisation of the acid gastric juice by 5 p.c. sodæ carb solution and the stoppage of intestinal peristalsis by intra-peritoneal injection of tincture of opium. Control animals were treated in all respects in the same way with the exception that they received sterilised broth instead of cholera material. The results were as follows: Out of twenty-one guinea-pigs fed with Koch's bacillus, nineteen died with distinct symptoms of cholera. Koch's bacilli were found in the mucous flakes of the rice water stools, and in the mucous membrane of the small intestine. From the first dead animal the intestinal contents were removed and given with food to another, and so on, through ten generations with uniform results. The control animals survived, thus showing that the administration of soda solution on the injection of opium did not cause death or choleraic symptoms.

Koch's bacillus can now be isolated in the majority of cases and differentiated from most of the comma bacilli by its chemical and biological characters. Professor Brieger has discovered a chemical poison in Koch's comma culture, which is isomeric with cadaverine, and produces on hypodermic injection of animals muscular spasms and collapse as in cholera.

A. Powell (Cachar) believed that the weak point in Haffkine's inoculations was that one attack of cholera was in his experience no protection against another. He had known many cases die of a second or third attack. The immunity, if any, was short-lived. The disease in this respect resembled gonorrhœa or influenza more than smallpox and the specific fevers.

E. Lawrie (Hyderabad) said they must all welcome any proposal or measure which had for its object the prevention of cholera, and admire anybody who, like M. Haffkine, endeavoured to stamp out the disease in the energetic way he had. But they must not allow their admiration of M. Haffkine to obscure their vision or consideration of actual facts, and he ventured to bring to their notice a few facts with regard to the inoculations for cholera, for the purpose, he assured them, of furthering progress in the direction in which M. Haffkine was working.

M. Haffkine had stated a well known fact—animals could not contract cholera. The question then was—what condition was produced in animals by inoculation with the attenuated decoctions or cultivations of the comma bacillus? It must be some form of septicæmia, not necessarily infective, and they must bear in mind that almost all forms of septicæmia might be in their nature, either very mild and harmless, or very severe and uncontrollable. We know that in septic poisoning in man or in animals diarrhœa was often a prominent symptom, and was also a common cause of a fatal termination of the disease. The next point that had to be determined was whether septic poisoning in any form was ever safely curative or preventive of other diseases. Three examples occurred to him, in which it had been proved to exert a curative action. It was long ago discovered that in indurated ulcer of the leg accidental attacks of erysipelas caused the thickening to disappear and the ulcer healed up; and this led to blistering in ulcers of this kind as a safe and effective imitation of the unsafe erysipelas. The second example had been brought to his notice only that morning by Surg.-Lt.-Col. J. O'Brien; a patient under his care, for compound fracture of the leg of several weeks standing, got general dermatitis, and when the dermatitis subsided, the wound was found to be so much improved that it forthwith commenced to heal and speedily got well. The same kind of effect had been observed in the Koch cure for tuberculosis. The local effect was in certain cases beneficial, but the constitutional effect could not always be kept within safe limits, in fact the case showed itself to be dangerous.

In the same manner they now had Haffkine's inoculations brought forward as a cure or preventive for cholera. These inoculations produced a period of illness, generally slight and harmless, as compared with that produced by Koch's tuberculin, but, like that, a form of blood poisoning. The question next arose was septicæmia in any form whatsoever a preventive of cholera, and, if so, to what extent? If mild attacks of blood poisoning or septicæmia could be proved to protect entirely, or to any appreciable extent, against cholera, there would be some ground for claiming protection to the same extent by Haffkine's inoculations or vaccinations. But nothing of the kind had been proved as yet, in fact the evidence was so far all the other way. It appeared to him that cholera was much too complicated and serious a condition to be accounted for by a cause so simple and easy to deal with as the comma bacillus. Moreover, bacteriologists themselves were not agreed as to the identity of the microbe, and cholera cases were certainly met with everywhere in which the comma was not even a concomitant of the disease. Lastly, in order to make out the semblance of a logical case for the comma bacillus, M. Haffkine was bound to show that it was present in the organism prior to the commencement of the symptoms of the disease it was said to cause. There was little doubt cholera might be driven away by a pure water supply. What it was in dirty or infected water, which gave rise to cholera, was a point of the least importance, and he for one was content to leave it to bacteriologists to discover.

Mons. Haffkine, on the invitation of Dr. Crombie, the President, said that he would offer a few explanations to the remarks made by previous speakers. In the first place it was necessary to say that it was an error to connect the question of septicæmia with that of the inoculations.

The inoculations were *not* based on septicæmia. About ten years ago, in a controversy which was then carried on relating to the bacteriology of cholera, the question of septicæmia had arisen, but that question had been long set at rest. To make himself understood perhaps it was necessary to explain what septicæmia really is. Among pathogenic microbes three different groups have been distinguished by their relation to the diseased body. First there are microbes which, when introduced into an organism, remain at the point where they have been placed and produce a localised infection. The microbes grow and multiply exclusively at the seat of inoculation; they there secrete their poison or toxin which is absorbed into the general system and produces the general symptoms of the disease. To such microbes belong the bacillus of tetanus which lives only on the surface of the wound, and at the seat of its introduction; the bacillus of diphtheria which remains exclusively on the affected mucous membrane; the bacillus of pneumonia which confines itself to the lungs, and the comma bacillus of cholera which lives in the intestines. These microbes never penetrate into the blood. Again, there is a second series of microbes which penetrate into the tissues of the affected organism, and, not spreading uniformly, live in small isolated groups. These microbes cause the tuberculous diseases, such as consumption, glanders, leprosy, actinomycosis, farcy of the Guatemala bullocks, diseases produced by *aspergellus fumigatus* and other fungi, &c. These microbes also do not penetrate into the blood. The last group of microbes are those wihch invade the circulatory system. When introduced in any part of the body, whether under the skin or in the muscles, or in the lungs, or into the intestines, they do not remain there for any length of time, but very soon reach the vessels, multiply in the blood, and after a short time can be found in every drop of blood examined and in every tissue. To such microbes belong the bacillus of anthrax, of gastro-enteritis of fowls, of pig measles, of swine pest, of the cadaveric infection of students, of influenza, of the Chinese plague, of Malta fever, and of the typhoid of mice. In these cases the blood is in a state of sepsis or of suppuration, and it is only these diseases which are called septicæmic diseases. Erysipelas in lupus does not act by *septicæmia*, nor can tuberculin, which does not contain living microbes, act on lupus by producing septicæmia. No substance, no poison, organic or inorganic, however deleterious it may be, can produce *septicæmia.*

Now in regard to cholera the question of septicæmia had been raised by Dr. Klein, of London, under the following circumstances: While seeking for proofs as to the comma bacillus being the cause of cholera, the action of these microbes were tried on animals, and Koch published his method of infection of animals by the mouth, with the introduction of soda into the stomach and the injection of opium into the peritoneal cavity. Under these conditions guinea-pigs contract a disease in which the comma bacilli multiply in the intestines, but in which the microbe can also be found in the blood. Dr. Klein therefore objected to this result as a proof of comma bacilli being the cause of cholera, on the ground that *in man cholera is a localised infection* with the microbes in the intestines and never penetrating into the blood, whereas in guinea-pigs Koch's method did not produce cholera, but gave a septicæmia. The fact of comma bacilli giving septicæmia to guinea-pigs under these conditions is not, however, an objection to their being the cause of cholera. Microbes do not behave in the same manner in different species of animals, and there are some which in one species will produce a localised disease and in another a septicæmia. Thus the pneumo-bacillus of Frankel gives in man *pneumonia*, a localised disease, while in the rabbit and the mouse it produces a septicæmia and in sheep a localised disease similar to pneumonia in man. The comma bacillus therefore may very well give to localised infections of the intestines, and at the same time, when transferred into guinea-pigs, spread by the blood and give a general infection.

No one who has given the subject his attention has ever entertained the idea that the anticholeraic inoculations have anything to do with septicæmia. Comma bacilli are almost instantaneously killed in contact with human blood, and the difference which is observed in this respect between cholera in man where no trace of microbes can be found in the blood, and Koch's disease in guinea-pigs, constitutes the very objection used against the doctrine of Koch. Persons who have not had the opportunity of studying the question confuse the details and transfer the word septicæmia from the controversy referred to, to the question of anticholeraic inoculation. To say that this treatment is based on septicæmia, it is necessary to demonstrate, after inoculation, the presence of microbes in the blood, a demonstration which has never been made, nor has the slightest suspicion that these inoculations produce a septicæmia ever occurred to any competent authority.

With reference to the question of second and third attacks of cholera, Mons. Haffkine did not think that such a fact would be an objection against the possibility of producing an immunity artificially. Be this as it may, the question of immunization by one attack of cholera is far from having been elucidated. It cannot be solved by several instances of men being attacked a second or third time. Similar instances can be quoted as regards small-pox. The protection of one attack of small-pox has been proved, not by isolated instances, but by the comparison of the liability to the disease between a large number of men who never have had small-pox, and those who have previously had one attack. In cholera such a comparison had *never* been made. The idea of an attack of cholera not protecting against a second attack rested solely on a general impression derived from isolated cases. He would quote an instance. The Chairman of the Calcutta Municipality, after receiving Dr. Simpson's first memorandum on anticholeraic inoculation and his recommendation to introduce the system into Calcutta, asked the leading medical men in the town their opinion on the subject. Dr. O'Brien replied that he did not believe in the protective effect of these inoculations because of second and third attacks in cholera. A short time after this Dr. O'Brien, with true sincerity, wrote a second letter to the Chairman, saying that he had met Dr. Simpson and Mons. Haffkine, and that when he had asked himself in the course of the conversation how many cases of second attacks of cholera he had come across, he was obliged to acknowledge that he could not remember having observed any. Mons. Haffkine was collecting information regarding the fatality of second or third attacks of cholera. He had observed that, though it is not rare to meet physicians who know of such attacks, it is rare to come across fatal cases. First attacks in cholera are on the average fatal in one case out of two or 50 per cent., whereas second or third attacks seem to be fatal in 1 out of 20 or 30, *i.e.*, from 5 to 3 per cent. Surgeon-Colonel Harvey, the Inspector-General of Civil Hospitals in Bengal, and Surgeon-Lieutenant-Colonel Roe, the Sanitary Commissioner of the Punjab, had mentioned to him that they had never come across a single case of second or third attack of cholera, and were in doubts whether a single observation of this kind had ever been made. At present, therefore, a general impression cannot be used to oppose exact laboratory experiments.

The President in conclusion said he could not allow this discussion to close without asking from this section an expression of its appreciation of the magnificence and splendour of the mission on which M. Haffkine has come to India. He arrived among them nearly two years ago, a stranger, very imperfectly acquainted with the language spoken, and with no adequate idea of the difficulties which lay in the way of his putting his theory into practice; though those living here had no difficulty in anticipating them. He has overcome those difficulties in a way which nothing except his indomitable perseverence, and a perfect belief in the truth of his teaching, could have enabled him to do. He has done it at his own expense, though he was glad to say that Government has assisted, and was still assisting, with a small subsidy. He, however, regretted that in carrying out his great mission, he has sacrificed his own health, though he hoped only temporarily. Whatever differences of opinion there may be as to the theoretical basis for his method of inoculation, and whatever may be the ultimate verdict on the results of the experiment which he has been making in our midst, they could not withhold from him the expression of their high sense of the magnitude of the task he has set himself and of his devotion and fortitude in carrying it out. (Prolonged applause.)

A TYPICAL EPIDEMIC OF CHOLERA.

BY D. MORISON, M.D., C.M.

About the middle of October an annual *mela* is held in the District of Rajshaye, at a place called "Ketre," 12 miles distant from Rampore Bauleah. Every year as the *mela* ends cholera breaks out either in the *mela* itself, or along the course taken by the pilgrims on their way to their homes. Some years so-called sporadic cases occur within the municipality of Rampore Bauleah; at other times it assumes the form of an epidemic. I have observed these visitations for many years, and in every epidemic found good reason for believing that the water-supply at the river ghats, or in the numerous tanks, was contaminated by cholera dejecta. This year having traced one of these miniature epidemics, which occurred shortly after the *mela*, to its source, I thought it might be of interest, and worthy of record as a typical epidemic of cholera.

On the 29th October last a man came to the Mission Dispensary for cholera medicine for two patients who were ill in a village called Bindarampoor, about three miles from my dispensary. He stated that four persons had already died, and that two others were ill; but that the first case—a woman who had been to *Ketre mela*—had recovered. I did not find it possible to visit the village till some days after, but meantime ordered them to close the well in the court-yard of the house where the first cholera case occurred. I had learned from the messenger that the woman who had been to *Ketre mela* defæcated near the well from which the family and others obtained their drinking water. The order to close the well was not complied with, until some more fresh cases occurred, after which the well was abandoned. After a few days I visited the village, got as many of the people together as I could, and asked them particularly regarding the water-supply of each house in which a case of cholera happened. I found that every house, without exception in which cholera had appeared, took their drinking water from the well in the court-yard of house No. 1. I also examined the place on the verandah, where case No. 1. slept, and the place where she latterly defæcated. It was exactly seven feet six inches from the well. The well itself is what is called a *kutcha* well. It is lined with burnt clay rings to keep it from falling in: its diameter is 22 inches, and the surface of the well-water was 2 feet 6 inches from the ground level. During the illness of the first case, the unseasonable heavy rains which fell towards the end of October occurred. Thus, the conditions for the actual contamination of the well-water with cholera dejecta could scarcely be more favourable, unless they were dropped into the well. The results of the epidemic—12 cases and 10 deaths—prove, I think, that infection of the well-water must have taken place, either through soakage and filtering down of the surface water containing the virus, during and after the heavy rain; or, possibly, by the woman herself, in the act of drawing water from the well, with her hands (the left hand is invariably brought into actual contact with the fæces in the process of ablution after defecation), conveying the virus to the rope or vessel with which the water is lifted.

The following table shows the results of the epidemic in the village:—

House No. 1 ...	1st case ...	A woman	aged 55	recovered.
	2nd „ ...	A man	„ 40	died.
	3rd „ ...	A woman	„ 35	„
	4th „ ...	A man	„ 25	„
House No. 2 ...	5th „ ...	A woman	„ 25	„
	6th „ ...	A woman	„ 30	„
House No. 3 ...	7th „ ...	A woman	„ 40	„
House No. 4 ...	8th „ ...	A boy	„ 12	„
House No. 5 ...	9th „ ...	A woman	„ 35	,
House No. 6 ...	10th „ ...	A child, female	„ 3	„
House No. 7 ...	11th „ ...	A woman	„ 60	„
House No. 8 ...	12th „ ...	A man	„ 30	recovered.

These were all the cases that occurred during the epidemic in the village, and all these households took their drinking water-supply from the well in the court-yard of the house No. 1. There was one house, much nearer the infected house than some of the houses attacked, in which no case of cholera occurred; but the man himself gave the explanation, by informing me that he had a well of his own, and did not require to go to the well in house No. 1 for water. These deaths all took place, subsequent to the illness of the first case.

There are some points of great interest and importance connected with this epidemic to which I wish to draw attention: (1) facts like these, and they are common in Bengal every year, should make one hesitate to state publicly, as Dr. Duka did at the 8th International Congress of Hygiene and Demography, that "attacks of cholera occur in numerous villages at a distance, which do not use (contaminated) river water at all. How did these wells and separate and independent sources of water-supply get their comma bacilli?" *

The answer is given by the facts connected with the origin and spread of this epidemic; and, I believe, a similar answer could be given in every such supposed sporadic case if we could only trace as easily the different ways by which the virus or bacillus is conveyed to the alimentary canal.

Another illustration of the same point was afforded a fortnight later by a case of cholera which happened in a village named Bhirmerdang, one mile and a half north-west of Bindarampore. It looked uncommonly like genuine "sporadic cases," for I could trace no direct connection between the villages during or after the first epidemic. The infection could not be carried by the wind, as the prevailing wind was north-west. I enquired where the boy had been before he took ill, and learned that on the 14th November he had accompanied his uncle on a cart to Rampore Bauleah, five miles distant, where cholera cases were occurring almost daily. He remained there that night, took food and returned on the following day, 15th November, on the evening of which day he was seized with cholera; but eventually recovered. Then his grandfather, two brothers and a little girl took ill and died, four deaths in all confined to one house. Another case was said to have occurred in the next house, but the woman recovered. Outside of these two houses no cases of cholera occurred in the village. The epidemic ceased entirely. I again made minute enquiries a week or ten days after, but no other person outside these two families took cholera. All the other villagers were independent of that house; each house had its own well, and hence the epidemic was limited to those who came into direct contact with the boy who brought the disease to the village. A little careful enquiry was sufficient to elicit information that entirely dispelled the "sporadic theory."

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* "Lancet," 8th September 1894, p. 563.

(2.) Dr. Duka further says: "And when the disease attributable to the presence of these micro-organisms in well-water ceases, what becomes of the enormous crop of these microbes, or why does the bacillus so suddenly lose its pathogenic properties to become innocuous?" It is a question that naturally occurs to any one who has given attention to the disease. We have long been familiar with the undoubted fact that in all great epidemics of cholera there is a brief period—very brief in most epidemics—during which the virus has not seemingly attained its maximum virulence. A second period, longer in duration, of intense virulence, and a third period at the close, when it is on the wane and about to become mild or even innocuous. The epidemic before us illustrates these periods very markedly. The first woman recovered, the last man attacked is living still, but all the others died. The same is also noticable in the second epidemic at Bhirmerdang. The first recovered, so did the last, all the others attacked died. Although we may not be in a position to give a complete answer to this question, or be able to explain the process by which the comma bacilli lose their pathogenic properties, yet the fact itself may be placed beyond doubt, and become available for practical purposes. That the virus of cholera does lose its pathogenic properties or become inert in water after a time has long been known; and the fact is once more emphasised in this epidemic—for the villagers began again to use the same well-water 14 days after the last case occurred, but no recurrence of cholera took place. Koch* whose investigations supply us with the most reliable information regarding the life history of the comma bacilli informs us (1) that the period of activity and growth of this micro-organism, in suitable media, is brief but extraordinarily rapid up to a certain point, then they begin to decline, and their growth is arrested, but after two or three days they shrivel up and die, or become a prey to other bacteria present in the media; (2) that in the tank-water at Calcutta, where the soiled linen of a cholera patient had been washed, the bacilli at the height of the epidemic "were so abundant that their number could not have depended on the dejections and washing water† from the cholera linen thrown at one time or another into the tank. Some growth must have taken place;" † that the comma bacilli, although anærobic, maintaining vitality without air or oxygen, yet require air or oxygen for their activity and growth.

If, now, we compare these characteristics of the comma bacilli with the behaviour of the infective material of cholera we are at once struck with the correspondence between the alledged cause and the results as observed in epidemics and individual cases of cholera. Let me repeat them briefly: (1) the comma bacilli develope with extraordinary rapidity in suitable media, and subside in two or three days; so do the symptoms produced by the virus of cholera; (2) the bacilli die or become inert in water after three or four days, so does the virus of cholera; (3) the infective material of cholera, when it finds its way into well-water, must remain on or near the surface, as only the surface water can be lifted for drinking or culinary purposes. This also accords with what we know of the comma bacilli; they come to the surface to obtain from the air oxygen necessary for their growth and development. That the bacilli after becoming inert should again become virulent on passing through the alimentary canal of the human subject is to be expected from what we know of other infecting material. Thus the virus of rabies, the virulence of which has been diminished by passing through from monkey to monkey, may again be made intensely virulent by passing it through from rabbit to rabbit or guinea-pig to guinea-pig.

I do not say that these facts answer the question *how* the virus of cholera becomes inert; but I do say that indications are not wanting in these investigations that the present trend of scientific research is in the right direction.

It will readily occur to one familiar with the above facts that the cause of an epidemic of cholera tracked to a sheet of water contracted into a superficial area of less than four square feet (that being the area of the surface of the well), presented a unique opportunity for finding the microbe outside the human body, completing the missing link and thus proving beyond doubt that the comma bacilli are the cause of cholera. This occurred to me at once; and I further thought that, if it could be contracted into a surface of 22 square inches, why not still further contract it to less than half a square inch? This I attempted to do by taking a clean glass-stoppered bottle, full of the surface water of the infected well, during the height of the epidemic, and letting it stand for 24 hours or longer to allow the microbes time to come to the surface in contact with the air. The glass-stopper was removed, a glass cap admitting air freely, but excluding dust, was fitted on and the bottle set aside for examination. I had now I thought cholera microbes concentrated in a layer of water less than half a square inch and ready at will to be put on the slide, or cover glass of the microscope for examination. I examined one drop after another without definite result, and concluded to abandon the search, as handling the water was not without risk to myself and others at that time.

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* Dr. Robert Koch's Conference on Cholera, Berlin, July 1884.

† The people of Bengal always wash their cloths *in the tank*, or if by a washerman, it is done in the same way, not as in Europe in tubs, the water of which is thrown away.

The contents of the bottle were thrown away. Again I relented and sent for other two bottles of the water; but the epidemic had subsided, and it was doubtful whether the microbes could be there at all. I examined carefully, and at last was rewarded by the sight of a field of microbes answering, I thought, in every respect to the comma bacilli described and delineated by Koch.

I am, however, so convinced that the field was genuine that I shall not abandon the search, but apply the method adopted to the first suitable contaminated well I can obtain. The method is simple, and, I think, efficient for those who, like myself, may have neither time, talent nor apparatus for conducting investigations with pure cultures of the comma bacilli.

The impression left on my mind by this miniature epidemic of cholera at Bindarampore is not that it has taught us anything which we did not know before, but that it reiterates and emphasises the outstanding facts already known to us, *viz.*, (1) that cholera does not arise *de novo*; (2) that it is due to an infecting material contained in the cholera dejecta (I believe the comma bacilli) which can be conveyed to the alimentary canal by drinking water or other moist media; (3) that the virus loses its pathogenic properties after a time in well water; (4) that its virulence is intensified by passing through the human subject; (5) that those who come most into contact with infected water suffer most, *i.e.*, the women in the Indian villages. Since the above was written, I found that cholera was prevalent in two other villages. I investigated these epidemics to see if they would bear out the conclusions at which I had arrived. The following facts were elicited: (6) that looking to atmospheric conditions, rainfall and subsoil water conditions which may and do modify epidemics—for the cause of cholera—is only diverting us from the true cause of cholera, which will invariably be found to be connected with infected ingesta in some liquid or moist form.

Additional facts regarding Epidemics of Cholera at the villages of Koola Tickor and Goshaitpor.

I. The first case of cholera which appeared at *Koola Tickor* was a woman who took ill on the 19th October 1894. The soiled cloths of this case were washed in the village tank in which all the villagers wash their clothes and bathe. This tank also supplies the village with drinking water. The tank is about 50 yards square and lies north and south, thus :—N. E. the north end being nearest the village. The clothes soiled with cholera dejecta were washed at the *north-west* corner of the tank, and all the 28 cases of cholera which occurred in the village up to the 15th December 1894 bathed at and obtained their drinking water from that corner of the tank. Those who bathed and used the water at the *north-east* corner of the tank were free from cholera. The epidemic went on continuously for seven weeks. On the 15th December I visited the village and found the epidemic as severe as it had been at any time during the previous seven weeks, and it gave no indications of abating, six persons being ill on that date. I was informed that at the end of the first fortnight there were indications that the epidemic was abating, but immediately afterwards it began again as severe as before. I explained to the assembled villagers the sources and media of contagion, and urged them either to abandon the tank altogether for a time, or to boil all the water taken from the tank before using it.

There were 28 cases of cholera up to the 15th December, and after that date up to the present time no new case had occurred. They rigidly adhered to the instructions given, and the result was as stated. The epidemic which had gone on for seven weeks ceased entirely. The 28 cases consisted of 13 *women*, 10 *children under* 6 *years of age*, 3 *children over* 6 *and under* 12 *years and* 2 *men*. It may be asked why in this epidemic did the virus continue so persistent, since it was proved that the virus in the well-water epidemic at Bindarampoor became inert in the course of 14 days of its own accord? The answer is given by the ascertained fact that the soiled clothes from each cholera patient were washed in the tank, and thus as the first infection disappeared, it was replaced by a new infection of the tank-water through the soiled clothes from fresh cholera cases.

II. While this epidemic was at its height, a man and two children fled from *Koola Tickor* on the morning of the 1st December to *Goshaipoor*, a village one mile distant where cholera had not yet appeared. At noon of the same day one of those children, a boy 8 years of age, was seized with cholera. He remained that day and all night in a house, 10 yards distant from the village tank. On the following morning the villagers sent them back to *Koola Tickor*, but not before they had contaminated or infected the village tank. In 9 days there were 10 deaths in this small village. I visited the village on the 10th December, and told them not to use the infected tank-water, unless previously boiled, and endeavoured to explain to them the sources and media of contagion. They abandoned the tank and the epidemic ceased, no new cases having occurred after that date. In this village also the heaviest mortality fell on the women. There were 10 deaths, consisting of 7 women, 2 children and 1 man.

THE SEASONAL PREVALENCE OF CHOLERA IN THE PRESIDENCY OF MADRAS.

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It is the general belief in the Madras Presidency that the period of chief prevalence of cholera is in the cold months (November to January), and this belief is that usually quoted by sanitary authorities. This statement can be supported by an appeal to statistics, which, however, it is proverbial can be made to prove anything. Thus :—

MONTHS.	Rate per mile per annum of deaths from cholera for the decade, 1881—91.
May ...	0·8
June ...	1 0
July ...	1·7
August ...	1 6
September ...	0·9
October ...	0.6

MONTHS.	Rate per mile per annum of deaths from cholera for the decade, 1881—91.
November ...	0·8
December ...	2·4
January ...	2·7
February ...	1·2
March ...	0·7
April ...	0·6

But when these figures are carefully examined, it is found that leaving out of the question the numbers of deaths in the case of certain districts, there is exhibited, year by year, a greater incidence in months other than the cold season. Thus, in the following table, one cannot help being struck with the fact that whilst November, December and January occur as the chief months of incidence in some districts, as surely in others, June, July and August are those concerned.

Average monthly rate of mortality from cholera for ten years ending 1893.

	January.	February.	March.	April.	May.	June.	July.	August.	Sept.	October.	November.	December.	Total.
Ganjam ...	0·09	0·09	0·15	2·00	2·86	2 07	1·38	0·81	0·25	0·12	0 36	0·20	10·38
Vizagapatam	0·20	0·16	0·67	0·44	0·71	1·55	1·99	0·65	0·16	0·14	0·10	0·21	6·98
Godaveri ...	0·44	0·66	1 03	0·93	1·53	3·26	7·77	3·58	1·35	1 11	0 81	0·51	22·98
Kistna ...	1·52	2·25	2·23	1·61	1·08	0·67	2·13	3 58	1·10	0·44	0·32	0·25	17·18
Nellore ...	0·61	0·83	0 34	0·19	0·30	0·25	0 82	1·89	0·88	0·19	0·16	0·36	6·52
Madras ...	0 85	0·54	0·30	0·51	0 54	0·14	0·22	2·96	3·92	1·30	0·58	0·74	12·60
Chingleput ...	2·48	0·90	0·25	0·30	0·65	0·71	0 84	1·49	2·14	1·20	1·09	1 60	13·65
South Arcot ...	6·24	2·63	1·20	0·45	0·56	0 79	1·87	1·29	0·79	1·19	1·93	4·46	23·40
Trichinopoly	6·51	1·96	0·77	0·65	0·44	0·41	1·24	0·94	0·54	0·33	1 72	7·68	23·19
Tanjore ...	10·79	4·30	1·40	0·90	1·32	2·50	3·22	1·14	0·57	0·70	1·19	8·28	36·31
Madura ...	4·37	1·96	0·85	0·66	0·48	0·50	0·28	0.21	0·15	0·44	1 62	5·89	17·41
Tinnevelly ...	10·80	2·74	1·57	0·73	0 62	0·37	0·56	0·47	0·25	0·25	1·03	7·62	27·01
Kurnool ...	0·14	0·13	0·22	0·40	1·04	0·75	3·33	4·20	1·08	0·37	0·27	0·14	12·07
Cuddapah ...	1·02	0·67	0·24	0·02	0 11	0·38	2·48	3·53	2·56	1·33	1·64	1·25	15 23
Bellary ...	0·14	0·12	0·41	0·62	1·10	2·68	3·27	2·65	1·36	0·94	0·46	0·47	14 22
Anantapur ...	0·39	0·12	0·01	0 004	0·22	1·96	3·48	3·09	0·95	0·61	0·48	0·33	11·64
North Arcot ...	4·49	1·81	0·75	0·26	0·41	0 59	0 67	1.06	0·75	0·51	0·84	2·67	14 81
Salem ...	3·52	0·89	1·00	0·73	0·63	0·41	0·26	0 40	0 23	0·51	1·33	2·84	13·75
Coimbatore ...	2·85	0·97	0·46	0 98	0·74	0·62	0·44	0·94	0·50	0·32	1·48	4·85	15·15
Nilgiris ...	0 33	0·11	0·16	0 12	0·84	0·12	0·03	...	0·08	0·03	0 03	0·27	2·12
South Canara	0·36	0·12	0·02	...	0·02	0·12	0·15	0·53	0·37	0·68	0·62	0 93	3·92
Malabar	1·21	1·11	1·02	0·95	0·68	0 96	1·94	1·96	0·52	0·19	0·23	0·77	11·54

Still I may be told the fact remains that in the Presidency, as a whole, the greater number of deaths take place in the cold months, and that in respect to the ten years used for these calculations, it would appear that no month can be quoted in which, in one or other year, deaths from this cause did not take place in all districts. This objection would naturally lead to the enquiry as to whether the population of these districts were fairly equal, and, if not, whether it be correct to assume increased prevalence during certain months, merely from a consideration of the aggregate numbers ; that is, given an epidemic, might it not be expected to find more victims in a large population than in a small, irrespective of any question as to the influence of density of population upon the extension of epidemics ? If, therefore, with a view to testing this fact, all districts showing a marked tendency to visitation from cholera in the months of June, July and August, or, what is the same thing, during the S.-W. monsoon months, be grouped together, and those for October, November, December and January be formed into another group, the following figures are obtained :—

Group.	Area of each group.	Average population of each group.	Average population per square mile.	Total deaths for ten years ending 1893 in each group.	Average deaths in each district in the Group.	Average yearly incidence of cholera mortality per mille of average population.
	Sq. mile					
North-East Group ...	57,609	18,271,702	317	361,243	32,840	2·0
South-East Group ...	67,334	14,966,607	222	193,120	17,556	1·3

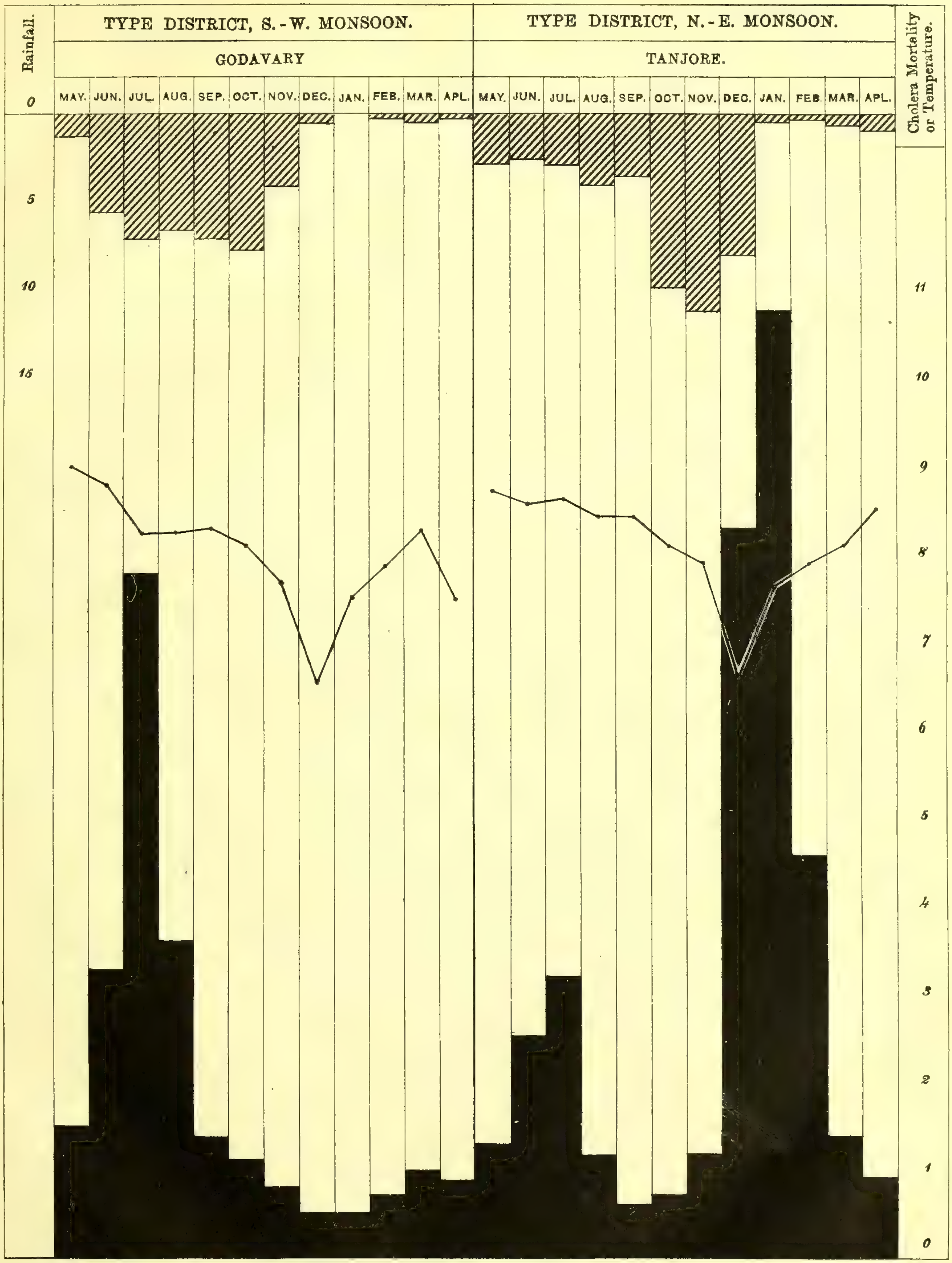
From this table, it will be seen that in the Southwest group the incidence of cholera is less per mille of population than in the north-east group, and that, moreover, there is a greater population in the latter liable to be affected. Hence the truth is, not that the cold months is the period of prevalence of cholera in the Presidency of Madras, but that the districts affected in these months which happen to have a larger population, return a greater aggregate number of deaths.

It is noteworthy that the N.-E. monsoon districts are nearly 10,000 square miles less than the S.-W. monsoon district, so that if area were the test applied, it might safely be said that the greater part of the Presidency does not suffer in the cold, but during the hot months—exactly the opposite of the usually accepted opinion quoted above.

Having got rid of this old theory, it would remain for us to ascertain why this distinct difference in seasonal prevalence of cholera should occur in closely adjoining tracts of country. In attempting to secure some solution of the question, I deal with the same figures as those already alluded to, namely, the registered cholera deaths during the years 1881–91.

No. 1.

Seasonal incidence of Mortality from Cholera in the Madras Presidency.



REFERENCES.

Rainfall in inches,........... thus ▨

Cholera Mortality per 10,000,...,, ■

NOTE.—In reading the temperature on this diagram, the scale should be taken to rise by ten instead of by one as marked.

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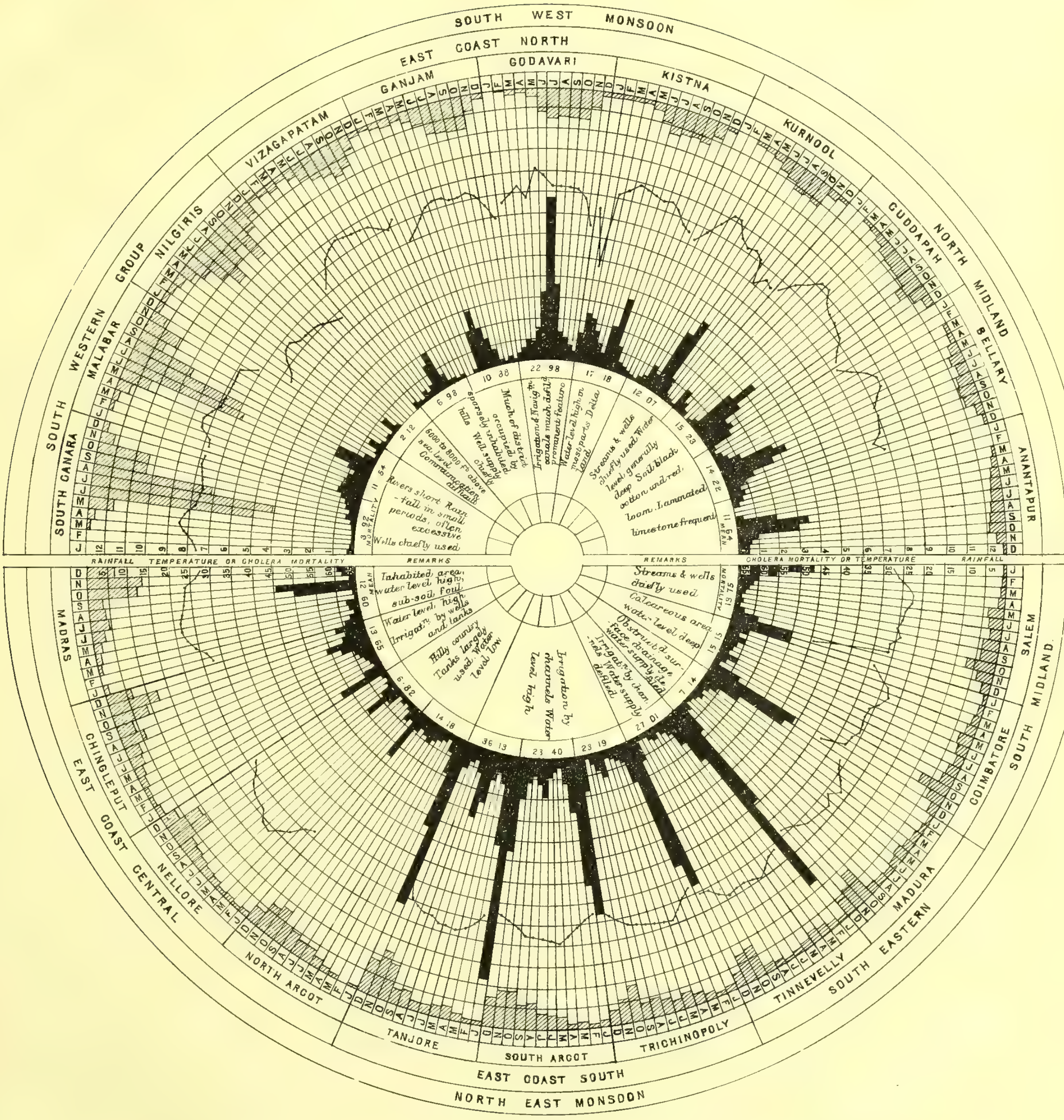
No. 2.



REFERENCE.

Shade represents Rainfall in inches.

Thick black represents Cholera Mortality per 10,000.

Hard line represents Temperature in degrees.

NOTE.—In reading the Temperature on this diagram, the scale should be taken to rise by ten instead of by one as marked.

In the notes within the circle the term "Water Level" is to be understood as applying to the Subsoil Water Level.

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Litho S. I. O. Calcutta.

Both the census of 1881 and of 1891 having been taken with much care in Madras, and no great factors for errors in respect of emigration, famine, or pestilences having been exhibited in the interval, I have elected to deal with the figures as to cholera mortality in relation to the estimated populations, as conducing to greater accuracy than when trusting to the census populations.

I have already remarked that during the decade 1881—1891 not a single district can be found which had a complete immunity during any one of the twelve months. To arrive, therefore, at an understanding as to the periods when they are chiefly affected, and to get rid of the factor of increasing populations, I have attemped to eliminate casual results and to secure a *type*, by calculating the ratio of deaths per mille per month for each district for the whole period. Thus, in contrasting one district with another, the less important features are not obtruded upon notice. There results a "combination photograph," in which the chief characteristics are by force of repetition made prominent. Reduced to the form of a diagram, it is found that if the districts be grouped according to the monsoons which chiefly affect them, two fairly definite types are evolved, of which that for Godaveri and Tanjore, respectively—both delta districts—may be considered as affording a fair idea (*vide* diagram No. 1).

These types show that in the case of a N.-E. monsoon district, prevalence of cholera waxes in October, and reaches its maximum in January, and by the end of February has rapidly diminished, but that in the S.-W. monsoon districts cholera waxes in May, increases rapidly in June, reaches its maximum in July, decreases in August and reaches its minimum in the months of December or January—in the very months when increase is being undergone in the other groups.

The above assertion taken by itself is a complete justification of Bryden's aerial current theory, which has been long rejected by the profession. Leaving the question of introduction of the disease out of consideration—which, however, I believe, was the essential part of this theory—it goes to show that tracts of country which are chiefly affected by the respective monsoons are those attacked during the period of their existence. But, in considering the meteorological effects of the monsoons, we have not only to deal with aerial currents tending in certain definite corrections during the months concerned, but an amount of rainfall which is usually also fairly definite in measurement, and a consequent fairly uniform variation in the amount and quality of surface and sub-soil water; variations as to humidity, electric condition, and barometric pressure must also be evident. Which of these factors brings about results referred to, or is it possible that it depends upon a combination of conditions?

Taking first of all Bryden's theory as to air currents, we know in Madras, which must be regarded as an extra-endemic area, the test of experience has shown it to be inapplicable. Surgeon-General Cornish, as Sanitary Commissioner for Madras, entered fully into this subject in an official discussion with Bryden, and, I think, left no doubt that aerial influence was *nil*. At any rate, nowadays with increased rapidity of communication and increasing care in observation, instances in which it is not possible to trace cholera to importation in the Madras Presidency, are daily becoming rarer, although cases are still brought to notice where cholera has asserted itself, without this explanation being applicable. Moreover, it would be a misapprehension to conceive that any district is devoid of influence from both monsoons. All are affected both by the N.-E. and S.-W. monsoons, but, as I shall show, in different degrees. Were the aerial theory correct, certain districts that feel the force of the monsoon in the greatest degree should be those most affected. That this, however, is not so will be seen by a reference to the following table:—

		S. W. MONSOON PERIOD.		N. E. MONSOON PERIOD.		INTERMONSOON PERIOD	
		Average rainfall in inches.	Average rate of cholera mortality per 10,000 of population.	Average rainfall in inches.	Average rate of cholera mortality per 10,000 of population.	Average rainfall in inches.	Average rate of cholera mortality per 10,000 of population.
Districts chiefly affected by S.-W. monsoon.	Ganjam ...	27·93	4·51	12·76	0·68	4·88	5·19
	Vizagapatam ...	26·27	4·35	11·94	0·45	4·41	2·18
	Godaveri ...	26·52	15·96	12·26	2·43	2·38	4·59
	Kistna ...	22·29	7·48	9·87	1·01	2·16	8·69
	Kurnool ...	18·31	9·36	7·59	0·78	1·76	1·93
	Cuddapah ...	14·23	8·95	12·08	4·22	1·85	2·06
	Bellary ...	13·25	9·96	6·60	1·87	2·61	2·39
	Anantapur ...	12·64	9·48	7·45	1·42	2·25	0·74
	South Canara ...	120·95	1·17	14·19	2·23	7·72	0·52
	Malabar ...	84·54	5·38	15·00	1·19	12·57	4·97
	Nilgiris ...	38·50	0·23	21·20	0·33	12·46	1·56
Districts chiefly affected by N.-E. monsoon.	Nellore ...	10·85	3·84	21·55	0·71	1·81	1·97
	Madras ...	15·56	7·24	31·31	2·62	2·37	2·74
	Chingleput ...	16·78	5·78	26·85	3·89	2·55	4·58
	North Arcot ...	16·29	3·07	18·75	4·02	3·12	7·72
	South Arcot ...	16·05	4·74	25·55	7·58	3·84	11·08
	Trichinopoly ...	10·89	3·13	17·12	9·73	5·20	10·33
	Tanjore ...	12·52	7·43	29·64	10·17	4·91	18·71
	Madura ...	7·19	1·14	17·02	7·95	5·61	8·32
	Tinnevelly ...	3·31	1·65	17·63	8·90	6·30	16·46
	Salem ...	13·62	1·30	11·26	4·68	5·57	7·77
	Coimbatore ...	7·12	2·50	11·67	6·65	6·51	6·00

Nor, on the other hand, does it seem probable that temperature is the great factor concerned. In the districts chiefly affected by the S.-W. monsoon (*vide* diagram 2) the period of prevalence embraces the highest temperature of the year; whereas, in the N.-E. monsoon districts, the opposite is the fact. Again, so long as a more readily demonstrable cause can be appealed to, I think it is safe to lay aside the more refined questions of the influence of humidity, electrical conditions, and pressure of the atmosphere. That variations of these conditions occurring in the monsoons doubtless cannot be ignored, as shown in the elaborate and valuable evidence of Surgeon Captain Herbert, I.M.S., but they must, I think, be regarded as incidental, and as overshadowed by the chief factor, *viz.*, rainfall, so far as the particular area included in the Madras Presidency is concerned.

If a map of Madras be examined, it will be readily understood that the presence of a range of mountains—the Western Ghats—of an average height of 3,000 feet so placed as to run parallel to the coast, and but a few miles inland, must prove a great bar to the S.-W. monsoon current, and must tend to cause precipitation of air-borne vapour close to the coast, thus robbing districts immediately on its eastern side; and again that, as at the Nilgiris there occurs a great angle formed by mountains from 6,000 to 8,000 feet high, and that thence the range gradually diminishes in height till it nearly reaches the East Coast, the whole range extending across the continent at an angle of 45°, there may be less bar to progress, but, at the same time, a continually less amount of vapour at disposal; and that tracts of country sheltered by the angle and by the close proximity to high ranges will secure less of this monsoon than those further removed from the West Coast, where the current approaching nearer the earth is able to make itself more felt. The same condition will affect the distribution of rainfall during the N.-E. monsoon, which advances at an angle from the opposite coast. The resulting apportioning of the monsoons is sufficiently definite to entitle certain districts in close relation with each other to be grouped together under a nomenclature referring to their geographical situation. Thus, if the districts be divided according as they depend for the major portion of the total rainfall per annum upon the S.-W. or N.-E. monsoon, it is possible to sub-divide these according to the amount of rain into definite sub-groups, which exhibit a decided relation as to geographical position in respect to the mountain ranges, and extent of territory over which the monsoons pass. If to this be added a study of cholera prevalence after the manner I have described in the opening of this paper, there is found at once a marked coincidence as to type. The result is exhibited in the accompanying diagram No. 2.

In a consideration of the influence of rainfall upon cholera epidemics, I think most will agree that the victims of this disease are subjected directly, or indirectly, to the poisonous products of a living microbe. Long before Koch maintained that he had in the comma bacillus found the virus of cholera, professional opinion had decided in favor of a specific organism. Cunningham's careful and prolonged investigation and Klein's criticisms on this subject leave this identification open to doubt; but the comma bacillus is at least in as close relationship to the cholera poison as the pilot fish is supposed to have to the shark. Whilst, therefore, leaving the question of the nature of the poison open, it is apparently safe to conclude that laws which have been ascertained to govern the propagation of the comma bacillus are also applicable to this unknown poison, although important links are absent, especially as regards the condition during prolonged quiescence. Granting, therefore, the poison of cholera derived from a former case of this disease is capable of existing in a quiescent condition in the soil, but of being awakened into a state of vigour by moisture with moderate heat, its passage into water-supplies either by sub-soil or surface flow, and into the atmosphere by air displacement, and thus into the digestive canal of the human being can be accounted for; but, if no other factors were involved, there ought to be exhibited a prevalence of cholera in proportion to the extent to which an area is inhabited under insanitary conditions, especially in relation to possible contamination of water-supply with reference to the distinct periods of the monsoons. To a certain extent this is so. The N.-E. monsoon district (*vide* diagram No. 2) clearly exhibits the influence of the S.-W. monsoons by a slight increase during the corresponding months, and, throughout the districts, the incidence of cholera is affected by the sanitary condition of local water-supply, as may be judged sufficiently by the short notes attached to each group. This missing factor, I am inclined to believe, will be found in the fluctuation of the sub-soil water.

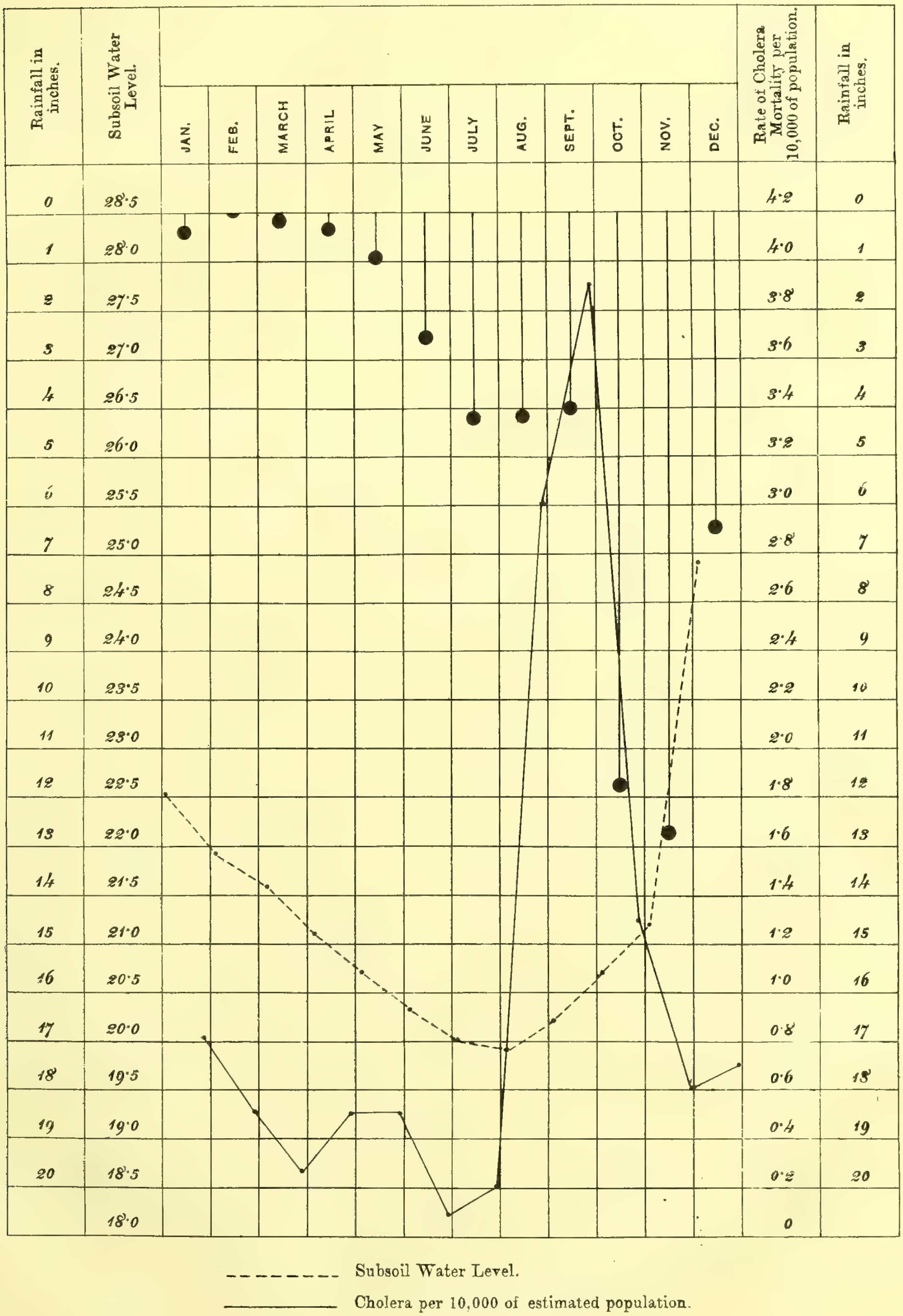
The researches of Pettenkoper and of Cunningham and Lewis have shown that whilst it is not everywhere demonstrable, connection between sub-soil and cholera incidence is traceable in certain localities. In reference to Calcutta, Cunningham and Lewis concluded that "the difficulties opposed by the phenomena of periodic fluctuation on the presence of cholera in Calcutta to the soil theory, are less than that encountered by any of the other current theories regarding the essential cause of the disease."

In dealing with a European country, where rainfall occurs at intervals scattered over the twelve months, the condition of the sub-soil water level varies within small limits when compared with results in this country. Hence, in drawing any conclusions as to the influence of sub-soil water level in Europe, it would be essential to place in evidence a carefully maintained record of observations extending through several seasons. In India, I think, if the area be very large as in the case of districts of the Madras Presidency representing a combined area of 141,189 square inches, deductions as to the state of the sub-soil water at any period may be fairly well drawn by referring to the rainfall. Of late years, the subject has been thought so little worthy of investigation that no continuous record of sub-soil water level exists in the Madras Presidency. Luckily, however, we have a record of the wells of the town of Madras during a period of fairly normal season of 1880 (see diagram No. 3).

It will be seen here that the maximum height of the sub-soil water level is gained in December, that is, *from the third to the fourth month after the commencement of the monsoon which chiefly affects this area.* Wherever I have travelled in the Presidency, I have carefully examined as to the sub-soil water level of localities (the marks on wells denoting the maximum height especially being readily recognizable), and I think it is fairly safe to state that this is the rule in all districts. But it is a point that I, of course, acknowledge cannot be accepted as proven, and which requires investigation before the statement can be finally accepted. Accept-

No. 3.

Diagram showing the Subsoil Water Level in Madras Town with the average Cholera Mortality per 10,000 and the average Rainfall for ten years.



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ing it, however, provisionally, it would follow that the sub-soil water annually reaches its greatest height in the N.-E. group of districts during the N.-E. monsoon, and in the remaining during the S.-W. monsoon. If this be so, it can be understood that, whilst in the N.-E. monsoon group the sub-soil water depression continues to increase in the interval between the annual recurrence of this monsoon excepting, in some districts, the occurrence of a slight *fluctuation* during the S.-W. monsoon, and that judging by the fact that rainfall of the S.-W. monsoon wanes so slowly as to be almost continuous with the N.-E. monsoon (*vide* diagram No. 2) in the S.-W. group, the maximum height of sub-soil water attained at the end of the third or fourth month of the S.-W. monsoon in these special districts, is fairly well maintained throughout the N.-E. monsoon period. In other words, the S.-W. group receives the greatest water-supply from the end of May to August, during which time the sub-soil water continues rising, and it then has little opportunity to undergo a marked depression, as the N.-E. monsoon is sufficient to maintain its height in the already moist soil; whereas, in the N.-E. group the S.-W. monsoon is capable of making at most but a small rise followed by an early fall, and it is not till the N.-E. monsoon sets in that rise in the sub-soil water level, reaching its maximum in the third to fourth month, is secured. So long, therefore, as *fluctuations* in the water level are proceeding, so long cholera is possessed of favourable opportunities for spread; but the moment its maximum or its minimum level is reached cholera ceases to be thus favoured. In one instance only is an *apparent* exception to this exhibited, namely, in the case of the district of Chingleput, of which Madras city geographically forms a part. Here, the commencement of season of cholera prevalence is coincident with the lowest annual level of the sub-soil water, and is especially marked during the slight fluctuation occurring in the months of August and September (*vide* diagram No. 3). The conditions peculiar to the city of Madras are a sub-soil highly charged with filth, and a maximum sub-soil water level in many places as high as 3 feet 6 inches. This exception seems to me to strengthen the theory that the moistening of layers of soil and the alternate displacements and re-entrances of air consequent upon rainfall brought about by fluctuation of sub-soil water before reaching its maximum height, are the main factors concerned in affording favourable conditions for the spread of cholera by influence upon the cholera virus in the soil. In the so-called extra-endemic area, under these circumstances, it is possible that cases of cholera may arise by the re-vivifying of formerly deposited virus, although it is probable that this is rare; but, having been put in motion and rendered vigorous by recent passage through the human being the usually recognized methods of spread following careless disposal of cholera excreta ensues. Importation of the disease by infected human beings is, however, by far the more usual means of propagation. But, to make a successful stay in any area, or to spread thence so as to become widely epidemic, it is essential that fluctuation of the sub-soil water following recent rainfall should be in progress. Hence, when infected pilgrims from Tirupati—the Madras Hurdwar—in the months of September or October proceed northwards, the disease they carry to their villages ends in a mere fizzle, but when they proceed southwards, there is an explosion that may cause immense destruction of life.

SOME OF THE NATURAL CONDITIONS AFFECTING CHOLERA SPREAD IN INDIA.

BY SURG. CAPT. H. HERBERT, F.R.C.S.,
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DURING the current year I have published a considerable amount of debatable matter on this subject in the *Indian Medical Gazette.* One of my main objects here is to ask those who may happen to have read any of these articles to state where they consider my evidence defective or my inferences strained. The information at my disposal has been limited. And I would ask those who have much experience in the spread of cholera to apply the test of detailed local application to the broad principles, especially concerning water supplies, which I have attempted to formulate.

Endemic Areas.—I claim to have established so close a connection between epidemic cholera and climatic conditions in the provinces of Bombay, Madras and perhaps Berar, as to prove that the disease is absolutely self-containing in each of these provinces. It needs no introduction from without.

The disease dies out completely at times purely under the influence of clearly definable natural conditions. It inevitably reappears as soon as the natural conditions are favourable once more; and in Bombay, where the meteorological influence on epidemics is comparatively simple, a fair proportion is evident between epidemic intensity and the strength of the meteorological influence. There is still a general impression prevalent that all cholera owes its ultimate origin to Lower Bengal; and that were this so-called endemic area wiped out cholera would itself disappear.

Now it stands to reason that, if the connection between the disease and climatic influence in the Bombay province be so absolute as I have stated, cholera must be widely endemic in this province. The difference in this respect between Bombay and Lower Bengal is one of degree only; and I believe the same may be said regarding Madras and Berar. I believe that were we to class the provinces of British India into endemic and non-endemic to cholera, Sind and the Punjab are the only ones that would fall into the group of non-endemic areas. The disease is no doubt mildly endemic in some of the Eastern districts of the Punjab, but it is of a feeble type. All the very severe manifestations there have been due to imported disease, spreading from Hurdwar fairs. I must own that I have quite failed to distinguish the natural conditions affecting cholera spread throughout the Gangetic plains. It needs a man more acquainted with the country; but the perennial presence of the disease, in some degree at least, in the N. W. Provinces, and the comparatively slight variation in annual cholera mortality there, seem to indicate that the disease is at least as endemic as in the Bombay province.

Transport by man and contamination of water supplies is constantly seen even in the old "endemic area"; and it is inevitable that the infection should be exported by these means more freely westward than the perhaps feebler virus can be imported thence into Lower Bengal. But the bulk and extent of this travelling westward from the delta of the Ganges has been exaggerated, mainly through Bryden's teaching. There must always be the *appearance* of movement westward in cholera epidemics in Northern India, for the chief cholera season is quite early, in the hot weather, in water-logged Lower Bengal. It is delayed as one goes westward, with the lessening annual rainfall, until in the Punjab the ordinary epidemics come "during and towards the end of the rains." The monsoon itself advancing from the East, blotting out the disease over the lower country and bringing the necessary rain for prevalence in the more western tracts, adds slightly to the appearance of travel in epidemics. There is still another factor, which I have alluded to* in treating of cholera in Berar. Suppose two consecutive years favourable to cholera prevalence throughout Northern India. In the first year the mortality in the lower Gangetic plains will be very much heavier than that in the Punjab. In the following year these Eastern districts will feel to some extent the effect of exhaustion of material of susceptible persons, and the mortality will hence be less. But in the west this will not be felt to any appreciable degree, and the fatality will be unchecked. Thus there will result a false appearance of motion in the two cholera epidemics. The so-called epidemic influence will seem to have concentrated itself more to the westward in the second year. It is not till we get on to soil, foreign or nearly so to cholera, as in the Punjab, that importation and movement of epidemics through human intercourse outweighs the influence of natural conditions. Compare the somewhat mild result of the great Ardodhoya Jog festival on the cholera rate of Bengal with that of a Hurdwar fair epidemic on the Punjab mortality.

In the *Lancet* of 1894 there is a reference to two types of cholera outbreak, the one attaining its maximum at once, the other rising gradually. Is not the former typical of an importation from without, under conditions unsuited to the continued development of the organism, and the latter characteristic of multiplication of the indigenous organism under increasingly favourable natural conditions?

Rainfall.—It is now generally accepted that large epidemics of cholera are mainly waterborne, infected individuals, infected clothing and the like, serving chiefly as links of connection between the various water-supplies. And it is even probable that, wherever disease is endemic, the organism has a permanent existence in some of the people's water-supplies. Unless this be so it is difficult to see how an epidemic due to an organism mainly waterborne, and that certainly requires to be swallowed, can make its appearance in a place during the dry season after perhaps a long interval of complete abeyance, without direct importation. Constantly repeated observations of instances of this led to the old belief in India that the disease must be airborne. Thus, it may almost be assumed that the weather elements influence cholera prevalence chiefly through their effect on the water-supplies.

I believe that meteorological influence on cholera is mainly threefold. As might be expected rainfall comes first in importance, temperature perhaps next, and atmospheric pressure last.

The influence of rainfall on the water-supplies and hence on cholera prevalence was discussed in a paper submitted to the Buda Pesth Hygiene Congress. The evidence brought forward was somewhat meagre, but it related to very broad tracts of country. It pointed roughly in the following directions:—

The provinces of continuously high ground water level have cholera all the year round. Here the rains flood in the tanks and wells and lower the cholera rate apparently by diluting the specific poison. The heaviest cholera mortality comes when the tanks are at their lowest. On the other hand, in the provinces of lighter rainfall and lower water level, it is found that the condition most favourable to cholera spread is departed from in the opposite direction. A very low ground water level completely abolished cholera prevalence. It appears likely that the observation* of the Sanitary Commissioner to the Government of India on the cholera at Bellary in the drought of 1877 will be found to apply to other parts of India and at all times. It was noticed that the point at which the want of rain began to lower the cholera rate was when the tanks and streams began to dry up, thus driving the people to the use of well water, then at a considerable depth.

From all this it would appear that the most dangerous water to use in cholera time is tank or other surface water when the water has run low.

Why should water deep below the surface be unsuited to cholera development? The water is probably purer, but the comma bacillus is stated to live longer in pure than in foul water; and deep wells in India are probably but little less liable to specific contamination than are shallow wells. For there can be little doubt that Indian wells become contaminated by cholera excreta, not so much by soakage through the soil, baked hard in the sun in the dry seasons, but rather directly by the washing of infected clothing on their margins, or through the introduction of contaminated vessels into their waters. One obvious explanation of the

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* "Indian Medical Gazette," August 1894.

* Annual Report of the Sanitary Commissioner with the Government of India for 1878.

CHART A.

PRESSURE AND CHOLERA OF BOMBAY PRESIDENCY (EXCLUDING SIND).

ATMOSPHERIC PRESSURE VARIATION.

Each space of distance away from Normal Line indicates ·002 inch of Barometric Level. The Monthly Means up to 1890 are taken from the Daily Means from 1891 onwards from 8 a.m. Observations Northern India up to 1890 is represented by Punjab Plains, Gangetic Plains, and Lower Bengal From 1891 by Indus Valley, Upper Sub-Himalayas, Gangetic Plains, Bengal, and Orissa Southern India by Madras and Bombay

CHOLERA—Each space up from Base Line represents 2,000.

DEATHS—Civil population during the year

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unsuitability of deep well water for cholera growth is to be found in its lower temperature, its removal from the influence of the sun's rays. On the other hand one cannot help thinking that there is something more than this; and that the habits of the people with regard to tank and river water have something to do with the development of the cholera organism in it.

As already stated it is not when the tanks are filled and overflowing that they are dangerous, but when their water runs low; when the number of people using them is greatest in proportion to the quantity of water available; when they become foul, not from the entry of sewage, but from the washings from the persons and clothing of the people, and by the constant stirring up of the mud from the bottom by the entry of men and animal. That the number of persons using a water-supply in this manner, both as a bathing ground and for drinking purposes, has something to do with the risk of cholera spread from it, is borne out by the history of Hardwar fair epidemics. Experience has shown that the element of greatest danger at these gatherings is the increase in numbers at Kumbh fairs. Two of the last three epidemics have fallen on Kumbh fairs. The explanation given by the Sanitary Commissioner to the Punjab of the origin of the third epidemic, that of 1892, when comparatively few pilgrims had assembled, is of interest here. The whole first half of the year in Northern India was exceptionally dry, the snowfall on the hills was one of the lightest on record, and the hot weather set in early and was abnormally intense.

The Sanitary Commissioner states*:—

"In the submontane tracts many of the streams
" were dried up...................... .The sanitary arrange-
" ments at the fair were those which proved so
" successful in 1891; it was impossible, however,
" to keep the water in the bathing pool so fresh
" as on the former occasion, on account of the smaller
" volume of water in the river, and the direct obstruc-
" tion to its flow in the sacred pool by recently formed
" obstacles and foreshores."

Thus each of the three epidemics may be said to have been characterised by one condition, and, as far as I can make out, by one condition only, *viz.*, excess in the proportion of bathers to the quantity of water available, brought about in two instances by increase in the number of pilgrims, in the third by fall in the volume and current in the sacred pool. The reasons why there was no epidemic in the Kumbh fair year 1891 may be stated thus: It was considered that the fair was kept free from epidemic by the very exceptional sanitary precautions taken. Also, the assemblage of pilgrims seems to have been much smaller than at the earlier Kumbh fairs, scarcely larger than that at the Adh Kumbh fair in 1885, when I believe no extraordinary sanitary arrangements were in force. Personally I think some share at least in the result may be ascribed to the complete reversal in this year, 1891, of the weather features mentioned above as characterising the cholera year 1892. All the early part of the year in Northern India was unusually wet and cold,* The probable effect of this on the water in the sacred pool may readily be imagined. One of the most striking features of these epidemics, and one especially to be insisted on here, is their rarity. The intervals between the last three epidemics have been eleven and twelve years respectively, quite free from general cholera outbreak at the fairs. It may be that only on these occasions of excessive crowding in the sacred water is the quantity of poison introduced sufficient to spread the disease. But this is unlikely if we may judge from the slight degree of pollution that appears to have been effective in spreading the disease during the late Russian epidemic (see *Lancet*, Oct. 13th, 1894.) One would expect more frequent and milder epidemics at Adh Kumbh fairs and in fairly dry years, when the chances of considerable direct contamination of the water must have been only a degree less than in the epidemic years. It seems more likely that the organism is able to develop and multiply rapidly under conditions attained only under the extremer degrees of crowding in the pool; that on these occasions only does the water become a very favourable culture medium; whether the result depend on the stirring up of the mud from the bottom or on the filth introduced by the bathers. This condition of water is of course very different from pollution by sewage, which is said to be unfavourable to the existence of the comma bacillus. It is perhaps not out of place here to bear in mind the very excessive cholera mortality seen in Berar in the heavier rainy seasons when the great thirst of the black-cotton soil is appeased and the whole country is "converted into a deep tenacious mud."

Atmospheric pressure.—There is not time to go into the influence of temperature and atmospheric pressure on cholera, but there is one remark I wish to make. I have endeavoured to show that, though in the Bombay province the heaviest cholera comes at a time when the barometric pressure is lowest, yet high pressure in this province has a powerful favouring influence on cholera development. It is interesting to find that typhoid fever in Queensland bears exactly the same relation to atmospheric pressure. Concerning it Hardie states †: "That although the period of highest barometric pressure—winter—corresponds fairly with the period of lowest mortality, the higher the barometer during any season of the year the greater will be the death rate."

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* Annual Report of the Sanitary Commissioners with the Government of India for 1892.

* The volume of water in the river may, in the absence of direct information, be inferred from the winter snowfall on the hills and from the atmospheric temperature and amount of rainfall on the plains of Northern India. Probably a table will be attached giving the attendance at the fairs, the snowfall and rainfall and atmospheric temperature of Northern India in different years. Also a few words to explain why the direct influence of temperature was probably quite of secondary importance. H. W.

† Atmospheric Pathology of Queensland, p. 101.

NOTE ON THE INFLUENCE OF RAILWAYS IN THE DISSEMINATION OF CHOLERA.

BY SURGEON-MAJOR J. LEWTAS,
Indian Medical Service.

One sometimes hears the remark made that since the introduction of railways into India, cholera epidemics are both more frequent in their occurrence and more rapid in their extension than used formerly to be the case. And as it seemed probable that railways would have this effect, I thought it would be worth while to investigate the matter. With this view I have selected especially the progress of successive cholera epidemics in the Punjab, because railways are of comparatively recent introduction in that Province. For instance, the main line to Peshawar was opened so lately as May 1882, whereas in what are known as the older provinces, railways existed before death-registration; hence there is no reliable information regarding the progress of cholera epidemics before the days of railroad communication. I have, therefore, examined the records of cholera as it has occurred in the Punjab, both before and since the introduction of railways, and the following remarks are, for the most part, based upon that examination.

Any influence which railways may have in promoting the spread of cholera would be expected to show itself in one or both of the following ways:—

(1) By a more rapid extension of epidemics, as compared with those which occurred before railways were opened, the extension taking place especially along lines of the railway which pass through centres of the disease;

(2) By disproportionate prevalence of the disease in places lying on or near to lines of railway.

An examination of the history of epidemics of cholera, both in India and Europe, shows that railways have had little, if any, effect upon their progress. Obviously individual cases have been carried further than would have been possible before the introduction of railways: for example, a man may have imbibed cholera poison just before taking his seat in a train, and may travel two hundred miles or more before symptoms are developed, whereas, before the days of railways, he would not have gone further than ten or fifteen miles in a bullock-cart. But such cases as this do not appear to affect the subsequent course of the epidemic; they neither accelerate its progress nor determine its direction. During recent epidemics of cholera in Europe, it frequently happened that individuals travelled considerable distances by rail from the place at which they had received the infection before the disease showed itself in them, but that no other case occurred in the towns or villages where they eventually either died or recovered. To quote an instance in India: At Meerut, in 1869, a sepoy was removed moribund from a railway carriage, and was carried to the lines of the 36th Native Infantry Regiment before he died. But no other case occurred amongst the native troops at Meerut, until a fortnight later when the advancing epidemic reached that place (see Dr. Bryden's report upon the cholera epidemic of 1869, page 53). Again, on the 14th April 1893, five men attacked with cholera were removed from a train at Saharanpur. Three of these died, but no epidemic ensued in Saharanpur.

The history of epidemic cholera in India does not show that the disease advances along lines of railway rather than by other roads. Sometimes, on the contrary, a line of railway remains outside, although close to an epidemic area. The map of the epidemic of 1869 is a very striking illustration of this. The disease that year attacked Allahabad on the 21st March, advanced slowly to Delhi, keeping almost exclusively to the south and west of the railroad, until at Delhi it left the line altogether and travelled to Lahore by way of Hansi and Hissar, parallel to, but distant a hundred miles from, the line. The country between Meerut and Amritsar, 250 miles in length, although traversed daily by trains, remained absolutely exempt from the disease. It is a fact, be the explanation what it may, that during the epidemic of 1869 there existed a large area of country extending from Shajehanpur to Amritsar, 400 miles in length, traversed by every means of communication, and in which Hardwar itself is included, which, nevertheless, was free from the cholera which was prevalent in adjoining districts. Other similar instances are to be found in the rather bewildering pile of literature which has grown up regarding cholera in India. I will mention only a few others: "In 1875 cholera advanced from Agra to Delhi, but no place on the line of railway between Delhi and Lahore was attacked." Again in 1879 it was noted, with the remark, that the fact was by no means peculiar to 1879, "that all along the Great Indian Peninsula Railway line, where the traffic is greatest, there was no cholera at all" (see report for 1879 of the Sanitary Commissioner with the Government of India, page 127). An examination of the map contained in the report of the Sanitary Commissioner, Bombay, for the year 1883, when cholera was epidemic in that province, shows that although the first case at Ahmedabad occurred on the 23rd August, yet there was no case at Broach, which is only 120 miles from Ahmedabad and in direct railway communication with it, until the 29th September, between five and six weeks later. Facing the map in that report there is a table giving the dates of first cases at different stations, and an inspection of this table shows clearly that the epidemic spread in a most erratic fashion, and was quite uninfluenced by the network of railways in its neighbourhood. The first case in Poona city was on the 6th April, but there was no case at Kirkee, distant only about three miles, until the 21st June. Observers of cholera epidemics in other countries also have been struck by the very erratic manner in which the outbreak extends. In the voluminous official reports of the cholera epidemic in the United States in 1873, it is again and again remarked that the disease showed no rule or regularity in its mode of progress. For example, at page 342, it is stated that "cholera in its travels northward frequently avoided one commercial point to settle in another and more distant one, although communications by steamboats and other modes of travel was uninterrupted. At later periods it broke out at some of the points which had been thus passed. For instance, the epidemic was in New Orleans in the beginning of February 1873, but it did not attack Chicago until June, and the town of Cleveland intermediate between New Orleans and Chicago was not involved in the epidemic until two months after it had appeared at Chicago. After giving other illustrations of its erratic progress, and instances also of its synchronous appearance in places remote from each other, the report goes on to state that "no connection could be established between the first fatal cases of cholera and any steamboat landing railroad depôt, imported cholera patient, or person from a locality where the disease had been prevailing."

Again, is there, as a rule, disproportionate prevalence of cholera, during an epidemic, at places lying on a line of railway? In considering this question it must be borne in mind that railways usually connect the more populous towns. I will refer to the epidemic of 1872 in India, which was a severe one, and examine the death-rates from cholera in different towns, all of which were within the infected area, but not all upon lines of railway. In that year the railway system did not extend beyond Lahore, but the epidemic extended from Benares to Peshawar. In Delhi the cholera death-rate of the civil population was 0·36 per mille, while in the neighbouring town of Karnal, which was not then on a line of railway, it was 1·78 per mille; in Umballa, on the line, it was 1·11; while in Sirsa, off the line it was 0·47; in Jullunder it was 0·52, and in Firozepore, off the line, it was 0·60. The heaviest mortality from cholera was at Kohat, distant 250 miles from the nearest railway station.

A comparison of the direction taken by the epidemic in 1872, with that in 1867, 1862 and 1857, shows that the introduction of railways have no effect upon it. Although he was not writing with any reference to this point, and perhaps on that account the remark has all the more weight, the late Dr. Bryden, in his review of the epidemic of 1872, says: "To write the history of 1872 will be to rewrite the history of each of the years, 1867, 1862 and 1857," thus implying that the extension of railway communication in the Punjab between 1867 and 1872 did nothing to modify the progress and course of the epidemic.

Further confirmation of this statement is to be found in a comparison of the epidemics of 1867 and 1879 in the Punjab. In both years the epidemic appeared at Delhi about the 15th April; also its date of appearance at Umballa was the same in both years although in 1867 there was no railway communication between Delhi and Umballa. At Lahore, too, the date of appearance of the epidemic was almost identical in both years, being a few days earlier in 1867, before the railway was open. Finally, in both years cholera made its first appearance in Peshawar at the end of April. I have prepared a chart which indicates the dates on which first cases of cholera occurred at various places in the Punjab in epidemic years, beginning with 1861. The authorities for the dates are noted at the foot of the chart.

Railways do no doubt frequently carry cases of cholera to a considerable distance; but I have searched in vain for any evidence to show that cholera cases thus transported give rise to localised epidemics, which would not otherwise have occurred in the places to which these cases were conveyed. If railways are a means of disseminating cholera, why are they not constantly carrying it from those endemic centres in which it is always present?

Before beginning this enquiry, I was inclined to think that railways must promote the epidemic spread of cholera; but after reading the histories of epidemic cholera, as it occurs in India, and also in other countries, I have arrived at the following conclusions:—

(1) Railways convey patients suffering from cholera to places which they would not have reached in the days before railways were opened, but such cases do not by themselves determine, or even appreciably influence, the course of the epidemic.

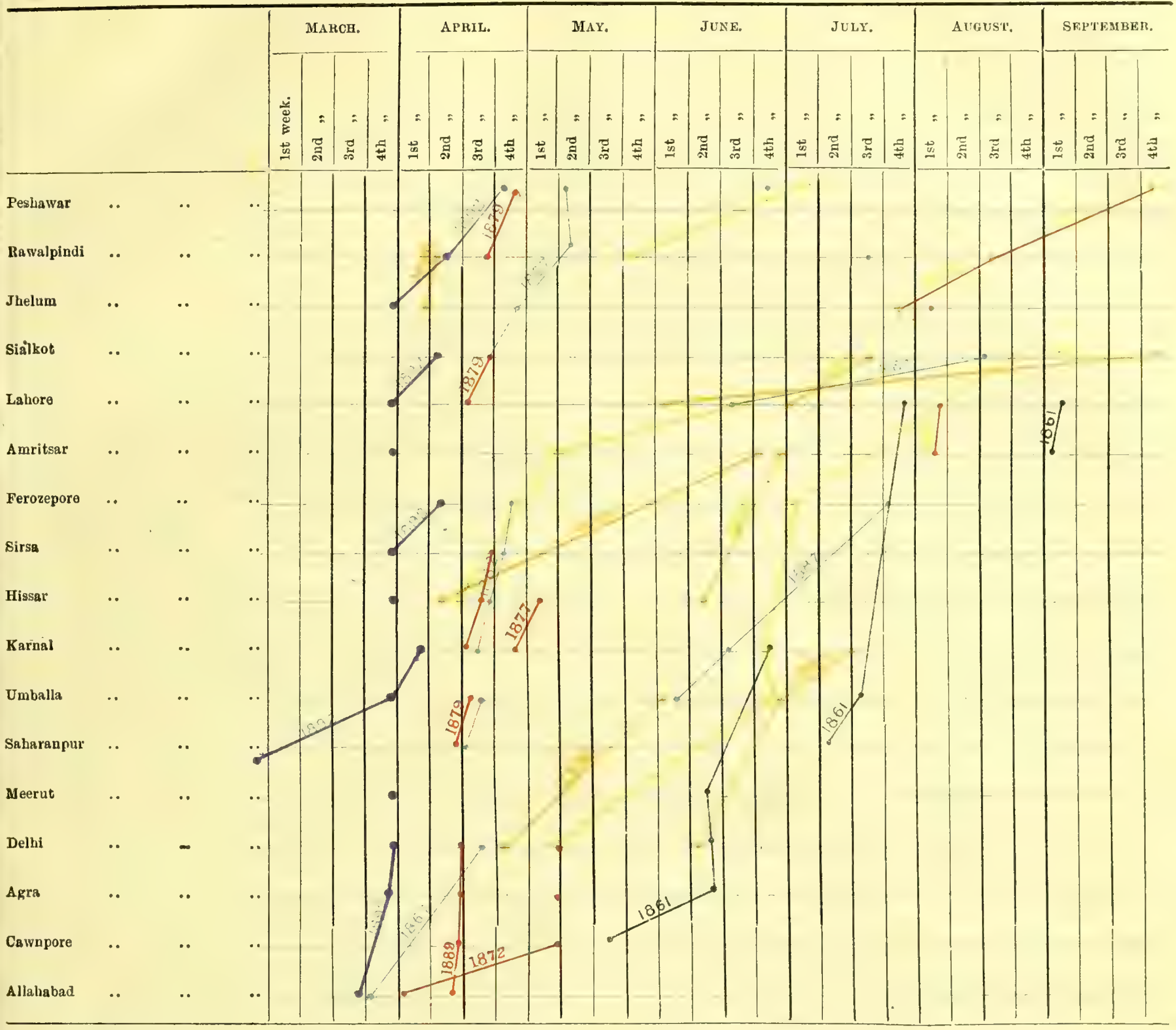
(2) Railways are a great safeguard to those who use them in order to escape from an infected locality; and as they constitute the quickest means of removing a large collection of people from any place in which cholera has appeared, their influence, so far as these people are concerned, is eminently salutary, and the consequent introduction of some cases of cholera to previously non-infected places is dangerous, only in so far as the sanitation of these may be defective. This statement is based, not only upon the records of Indian experience, but also upon those of the European epidemics of 1884 and 1885. In a supplement to the 15th Annual Report of the Local Government Board, page 107, the following passages occur: "The experience of cholera in England justifies a belief that the presence of imported cases of the disease at various spots in the country will not be capable of causing much injury to the population, if the places receiving infection have had the advantage of proper sanitary administration." Again, "cholera in England shows itself so little contagious that, if reasonable care be taken where it is present, there is almost no risk that it will spread to persons who nurse and otherwise closely attend upon the sick." One more extract from the same report: "Thus, when a case of cholera is imported into any place, the disease is not likely to spread, unless in proportion as it finds, locally open to it, certain facilities for spreading by

indirect infection." These and other references in this paper to European and American experience are not, I venture to think, irrelevant, because they show that those who have had especially favourable opportunities for observing cholera there, have arrived at conclusions which agree with our experience of the disease in India.

Again, in order to ascertain whether cholera epidemics are of more frequent occurrence in the Punjab since facilities for railway-travelling have been increased, I have had tables prepared for the chief stations in that province, both for those on the line and those distant from the line of railway, showing the cholera mortality for each year, from 1868 to 1892 inclusive. The statistics for troops, European and Native, for prisoners, and for the civil population, are given separately. The tables are bulky, and it is not considered necessary to reproduce them, as the statistics contained in them have already appeared in printed sanitary reports. Nor can much importance be attached to evidence of this sort, because in the last sixteen or twenty years many changes, besides the extension of railways, have taken place; chief of all, from the present point of view, has been the progress of sanitation. However, these tables, at any rate, establish the fact that cholera is not of more frequent occurrence than in the years before railways were opened.

If railways were a means of disseminating cholera, they would obviously convey it in every direction indifferently. But in the Bengal Presidency "the direction of an epidemic is always upwards," *i.e.*, towards the North-West Frontier. "Such a thing as an epidemic moving downwards is absolutely unknown." (Cholera: By Surgeon-General Cuningham, page 21). This fact alone would suffice to show that the influence of railways upon the distribution of cholera is inappreciable.

This short excursion into an outlying portion of the field of cholera enquiry shows that much remains to be known regarding the conditions which determine the spread of cholera. It was reasonable to expect after Koch's discovery of the cholera bacillus, that the investigation of every outbreak of cholera would resolve itself into a search for the bacillus. But the cholera vibrio has disappointed these expectations; it is found sometimes in water which people drink without any ill-effects, and it is not always to be found when cholera is present. "This is the reason," said Metchnikoff in his address to the Budapest Congress in August last, "that in the best bacteriological laboratories, including that of Koch himself, micro-organisms had to be declared as cholera genetic, which were not so considered before, and *vice versâ*." And Koch himself emphatically declared at the Public Health Congress at Magdeburg that a great number of secondary causes, such as local, seasonal, and personal conditions, have to come to the aid of the cholera-parasite in order to bring about a case of the disease. He regretfully acknowledged that little is known about these secondary causes, and that we are still confronted by many an obscure and unsolved question. In the annals of the Pasteur Institute for May and August 1894 Metchnikoff endeavours to explain the epidemology of cholera by means of its bacteriology, but it would lead me too far from my present subject to reproduce his ingenious explanations, which as yet are only hypothetical. The facts which I have brought together suffice, I venture to think, to acquit railways of any share in promoting the epidemic diffusion of cholera.



Authorities for 1861 epidemic, Sir John Strachey's Report.

„ 1867 „ Punjab Sanitary Report.

„ 1872 „ Report of the late Dr. Bryden and the Punjab Sanitary Report.

„ 1879 „ Punjab Sanitary Report, page 14.

„ 1887 „ Ditto ditto.

„ 1889 „ Punjab Sanitary Report.

Punjab Sanitary Reports.
„ 1890 „
„ 1891 „
„ 1892 „

Note.—These lines show that cholera does not "travel," for example, in 1890 it appeared at Jhelum five months before it appeared at Sialkot, and two months before it appeared at Lahore. Such metaphorical terms as "wave" and "travelling" should not be used in describing a cholera-epidemic.

It is instructive to compare the progress of cholera north of Lahore in 1890 and 1892 respectively; in the latter year the first case at Sialkot occurred only a week after the first case at Lahore; whereas in 1890 an interval of four months elapsed between the appearance of the epidemic at Lahore and the first case at Sialkot; and yet in both years the conditions of railway communication were identical. Again in 1890 the disease appeared at Jhelum two months before the first case at Lahore, while in 1892 these towns were both attacked on the same date.

TREATMENT OF CHOLERA.

BY A. MITRA, L.R.C.P., L.R.C.S.

Having had to deal with two most virulent epidemics of cholera in Kashmir during the years 1888 and 1892, I had ample opportunities to test most of the usual methods of treatment of that disease. I therefore now take this opportunity of relating to you the result of the treatment adopted by me and also of introducing for your discussion the subject of therapeutic treatment of cholera. At the very outset we are confronted with a disputed point. Supposing we are called to treat a case of cholera in the very first stage of the disease soon after the patient had one or two stools ; shall we or shall we not try to arrest the discharges from the alimentary canal and to allay the irritation of it by the administration of astringents and opiates ? If I am not mistaken, the practice in India is to exhibit astringents and opiates with a view to stop the discharges, and by lessening the drain from the system minimise the risks of the subsequent collapse. Side by side with my article on cholera in the Medical Annual (Wright, Bristol) of the year 1892, there appeared a valuable contribution from the pen of that distinguished physician, Sir George Johnson, in which he deprecates the administration of opium in the first stage and advocates an evacuant drug, such as castor oil, in order to get rid of morbid and offensive material. Koch, he points out, failed to produce cholera in guinea pigs, until at the time he introduced the poison into the stomach. He injected a dose of tincture of opium into the peritoneal cavity, his object being to render it possible for the cholera baccillus to remain longer and gain a footing in the intestine. "Is it not obvious," Sir George Johnson asks, "that those who endeavour to arrest the discharges by opium are repeating upon the human subject the lethal experiments which Koch and others have performed on guinea pigs." Sir George Johnson, however, says that a dose of opium may be given when the diarrhœa has continued for some hours, the stools being copious and liquid, and there is an absence of colic and abdominal distension. It is very curious to observe that this opinion of Sir George Johnson is an echo of the opinion which we find expressed in the Hindu treatise of Medicine called *Nidàn*. *Nidàn* says : "Do not attempt to arrest the evacuation in the first stage, that is, in the stage of diarrhœa," It advises a small dose of opium when the collapse commences. Our modern experience in India is just the reverse. In the earliest stage of cholera, by stopping the evacuations, we often succeed in stopping the course of the disease ; but when once signs of collapse set in, opium and its preparations do harm. As in a case of cholera, the treatment in the first stage is a most important one, and as in India during severe epidemics the pills and mixtures, which have to be largely supplied for the treatment of scattered and remote populations, all contain opium, it is a matter of great concern to Indian medical practitioners to know which of the above procedure is ratified by science and supported by experience. No experiment can be made during the overwhelming pressure of a cholera epidemic, and it is therefore in time of peace that we should be fortified with the knowledge which is the most reliable arm to fight with.

In the stage of collapse, I believe everybody agrees that diffusible stimulants are the only remedial agents which help us to tide over the crises of that stage. It has been seen that intravenous injection of hot saline fluid often produces good results, but such results are almost always temporary. During the reactionary stage the physician's resources are tried to the utmost, and every particular case has to be judiciously treated according to its own merits. The epidemic of 1892 in Europe and America has brought forth several new methods of treatment. I have had unfortunately no opportunity to test them ; but I doubt not that some of you here present who have to deal with endemic cholera may be able to tell us the result of their experience of them. The principle of these methods are, as you are aware, centripital arterial infusion.

Intravenous and intraarterial injection of sterilized solution of common salt or hydrogen peroxide.

Hot air and hotwater bath.

Opium subcutaneously before occurrence of collapse.

Subcutaneous injection of atropine.

Subcutaneous injection of anticholerine, a metabolic product of bacteria like tuberculin.

Subcutaneous injection of oil of camphor as a stimulant.

Cocaine and chloroform and irrigation of the stomach for vomiting.

Subcutaneous injection of hot saline solution in the algid stage in preference to intravenous injection.

Saline injection into the bladder.

Injection of carbonic acid into the stomach and intestine.

Diluted lactic acid.

Copious draughts of per-iodate solution internally and transfused under the skin.

Rectal injection of tannin or Cantani's enteroclytic treatment.

Washing the stomach and bowels with solution of hydrochloric acid.

During the epidemic in Kashmir in 1892, the treatment adopted by us was as follows : If a case was seen early, that is to say soon after the purging or vomiting or both appeared, and if as sometimes happens, signs of collapse were not present from the beginning, an astringent mixture with opium was administered every two hours for two or three doses. In such cases in which, on account of persistent vomiting, mixtures are not retained, morphia hypodermically, or opium and tannin enteroclytically, was administered. Two ready made mixtures were largely used. Mixture No. 1 contained dilute sulphuric acid, tincture of opium carbolic acid and creosote, and mixture No. 2 was made up with acetic acid, spirits of nitric ether, camphor and ammonia aromatic. In the first stage mixture No. 1 was administered ; a large mustard plaster was applied over the epigastrium. Hot water bottles and friction or hot water bath were employed to relieve cramps. Acidulated water or mint and camomile tea was given to quench thirst.

In the collapse stage opium and its preparations were strictly forbidden. Mixture No. 2 was largely used. During reaction, if the temperature rose, the bath was used; if liver was inactive, small doses of calomel were given. To stimulate the kidneys, tincture of cantharides was given internally with local counter-irritation. In cases in which there were signs of renal congestion or nephritis, cantharides was not used. Pilocarpine hypodermically acted very well in a few cases. To relieve cerebral congestion, a few leeches applied behind the ear often produced satisfactory results. Eighty cases were treated by me at the cholera hospital in Srinagar strictly according to the above method. Forty were cured and forty died, showing a death-rate of 50 per cent.

Fifty cases were treated with salol—22 recovered and 28 died, showing a death-rate of 56 per cent.

The effect of Lorbeer's cure of cholera was carefully watched in 50 cases, in 34 of which the medicine was commenced in the early stage; 14 recovered, 20 died: death-rate 58·8 per cent. In 16 the medicine was given during the collapse state; 5 recovered, 11 died: death-rate 68·7 per cent.

Hypodermic injection of morphia and atropia, combined with sulphuric and carbolic acid internally, failed to yield any satisfactory result.

No improvement followed in the treatment of four cases by argenti nitras internally and by enema.

In three cases cannabis indica was tried. One made a rapid recovery and two died.

In the collapse stage of five cases gum ammoniac internally, together with stimulants and injection of sulphuric ether, was tried, but no effect was produced. No appreciable result was observed after blistering the vagus. Besides the above, chlorodyne, lead and opium pills, patent pills, such as Cottor's, Daji's, and Bellow's alw-i-laj were also used. At the end of the epidemic, we found that out of a total of 16,845 cases, to whom some sort or other of medical aid was given, 5,133 were cured and 11,712 died, giving a death-rate of 59·53 per cent. It may strike you that we used too largely patent unknown drugs. I plead guilty to the charge; but my plea for doing so was partly that many of them were asked for by the temporary medical subordinates that were employed for the medical relief work, and partly that I wanted to give a fair trial to some of the patent cholera cures that find such ready market in India, and, once for all, to pronounce for or against them. I now take this opportunity to record unhesitatingly that by the use of these vaunted cholera specifics by amateurs much useful time is lost. If the State has no power to suppress them, I trust the authoritative voice of this assembly will guard the public against them. In my opinion alcohol is unnecessary in the treatment of cholera. In the collapse stage small quantities of champagne with sodawater may be given as a rapid stimulant; but spirits are seldom indicated, and I have never seen any good arising from them. I know of a gentleman who was travelling alone over the Himalayas and had a smart attack of diarrhœa and vomiting. He had nothing with him but whiskey, to which he helped himself freely and was cured. During the epidemic in Kashmir, he most sanguinely advocated to me the use of whiskey. Similarly, another gentleman thought he had discovered the specific for cholera after one day curing his servant from an attack of cholera, as he thought, by the administration of Worcester sauce in absence of anything else!

It must be admitted that our therapeutic resources for the treatment of cholera are still very unsatisfactory. In the *Civil and Military Gazette* of 16th June 1892, a medical gentleman advocated mustard emetic and quinine and calomel, and the writer said that he always tried this mode of treatment and never failed in one single instance, and guaranteed 95 per cent. cures. As soon as I read this I tried these medicines, following the writer's instructions in three cases of cholera. Two died and one recovered, the latter making a very slow progress. This hardly requires any comment. If we can catch the disease young, we often succeed in cutting short an attack, In fact, by judicious use of opium and astringents in the early stage, we can cure 30 per cent. of cases. When, however, the disease is unchecked, and when the evacuation stage is advanced, bordering upon the next stage of collapse, drugs are useless. Careful nursing is then the only helpmate to struggling nature. Recovery or death depends upon the extent of mischief produced by the germs and their toxic products. The constitution of the patient and vital resistance which his tissues are able to offer to the toxic products. During the stage of reaction, however, judicious treatment is of the greatest value, and many a life has been lost by neglect in this stage of the disease. It is not a cholera mixture, nor a cholera pill which should then be depended upon; but the symptoms of every particular case must be carefully observed, weighed and treated on principles based on rational medicine. The average mortality in fully established cholera cases is about 60 per. cent. in the beginning of the epidemic, 50 per cent. during its course, gradually falling down to 25 per cent. or less at the end of the epidemic. Any drug to have a distinct curative effect must reduce this mortality by at least 15 per cent.

I am therefore of opinion that until further scientific researches into cholera and its treatment throw more light on the nature of the disease and the weapon best suited to fight with it, "guarantee of 95 per cent. cures" cannot be made by a scientific physician. The subject of treatment of cholera is much complicated by the publication of immature hypothesis, and unless a physician is fully aware of the ground on which he is standing, he will jump from one drug to another, till at last he realizes his position. The microscopist, the epidemiologist and the practical physician has each to contribute his own quota, and the results of their researches and their experience when collected together will probably open out to us a vista of possibilities in successfully coping with the disease.

With these remarks, gentlemen, I beg to introduce to you the subject of treatment of cholera, and I have no doubt that the discussion would throw much useful light on this important subject. This is the first great assembly of physicians in modern India—I say modern India because there is evidence of Medical Congresses in ancient India, for Charaka says : "An assemblage of physicians is the foremost of all things that contributes certitude of diagnosis ;" also "conversation and discussion with professors of the same science is the foremost of all things that contribute to vigour of the understanding." I trust with Charaka that conversation and discussion on this important subject will lead to a better understanding of the therapeutics of cholera.

CHOLERA AND ITS TREATMENT.

BY BUNGA CHANDRA SEN.

My object is simply to bring to your notice the result of my 20 years' experience of the dire disease in a large area of tea gardens in Assam, where I have had ample opportunity of attending cholera cases in epidemics, not only as a medical man, but also as a friend and bedside attendant to my ignorant coolie patients. With this object in view, I venture to proceed with the subject under the following arrangement, namely: (1) Classification of cholera cases during an epidemic; (2) Source of cholera infection; (3) Treatment; (4) Conclusion.

(1.) *Classification.*—From my observation of the nature and course of the disease in epidemics, I may fairly divide its cases into three groups or forms, namely, (*a*) mild, (*b*) ordinary, and (*c*) severe. In all these forms, the cases bear, in degrees, most of the common symptoms of cholera, which are so well known to the medical profession that it is scarcely necessary to notice them all here, except a few for distinguishing one class of cases from the other.

(*a*) In the mild form, many of the known symptoms of cholera are distinctly marked, but they are not so prominent as in the other forms. The surface of the body is not extremely cold, nor the fingers and toes remarkably wrinkled ; the thirst is not so very maddening, nor the cramps of the extremities so severe ; the usual rice water appearance of the stools is never replaced by those of a pinkish or blood tint ; the voice never becomes very husky and whispering, and the pulse at the wrist is never lost, though it turns feeble and thready.

Of the stages, the early one is long, the collapse and the reaction being very short and not always perceptible. Cases of this class have always had satisfactory termination at my hands, except where some sort of neglect or other causes intervened. Such cases are more numerous towards the end of an epidemic, and some of them I have known to terminate favorably even when left to themselves.

(*b*) In the ordinary form, in which the three known stages are well marked, the symptoms are more distinct and severe. As the patient passes from the usual early stage to that of the collapse, he becomes very restless and thirsty, his pulse at the wrist sinks, but the pulsation of the brachial artery remains perceptible, the surface turns extremely cold and clammy, and the fingers and toes very much wrinkled ; his respiration becomes quick and laboured and the voice husky, but not completely whispering ; at intervals he falls into a semi-comatose state, the balls of his sunken eyes turning up ; but he is always conscious of nature's calls, which he sits up to obey. In this class, the duration of the early stage is shorter than in the former class and the collapse is longer. In favorable cases, the reaction follows in from 12 to 24 hours. Treatment of such cases has, under my care, proved equally successful and unsuccessful ; but here I should observe that, if all the cases could be taken in time and properly attended to, and other circumstances, such as superstition of the coolies against treatment in some cases, and dietetic irregularities in others, could be prevented, I am almost sure the result would be more satisfactory.

(*c*) In the severe form (I might justly call it the fatal form), the patient, after a very few stools (sometimes even after one or two stools), quickly passes over to the collapse stage with the symptoms aggravated to the extreme. In this stage his pulse sinks completely at the wrist, the pulsation of the brachial artery speedily but gradually becomes weaker and weaker, and then imperceptible, when we have to search for the pulse in the axilla. The patient passes now and then a pinkish stool unconsciously in semi-comatose state ; but in many cases the bowels in this stage remain inactive. When called, he only opens his mouth for water, and answers questions in a weak whisper, retaining full consciousness till before death, but falls back into the comatose condition as soon as he is left undisturbed. The surface becomes icy cold and clammy, and the fingers remarkably shrunken and wrinkled, as might be witnessed in a case of drowning just after the body has been recovered ; the nails turn blue, and the respiration becomes very much laboured and quicker and quicker, until the patient is relieved by death, which generally occurs in from eight to 24 hours. The restlessness and craving for water in the ordinary class of cases are in this class replaced by total exhaustion. The result of my treatment of such cases has always been unsatisfactory. Here I may mention that epidemics again are not all of one kind ; some I have noticed to be mild and others severe. In the former kind the cases are mostly of a mild form, and in the latter they are mostly of ordinary and severe form.

(2.) *Source of cholera infection.*—I have sufficient ground to hold that the chief abode of cholera poison and source of its infection is water. Oftentimes I have noticed the epidemics springing up from drinking from a certain streamlet or tank ; and here I may quote an instance in the form of an abstract from my medical report of the 17th May 1890, submitted to the Secretary of the Brahmaputra Tea Co. "On the morning of Monday last three cases of cholera appeared in our coolie lines, and we have since had 17 cases of cholera and choleraic diarrhœa, all except two being among the women only. It has also appeared with some virulence in our bazar and the adjoining villages, which are situated just on the Galabeal (a narrow streamlet supplying water to the bazar people and the villagers on its bank), the water of which becomes very much polluted at this time of the year. It is worth mentioning here that last week our coolie women worked for a few days on the Government road on the other side of the Galabeal, and it is quite possible that many of them drank (while working there under the sun) the Galabeal water, which was evidently impregnated with cholera poison." The above epidemic, which spreads further, but only among the specified women, is one of the many instances I have witnessed here during the past 20 years. At the Assamese villages in the interior, where cholera epidemics are almost of yearly occurrence, I have often seen its outbreak being confined to certain families drinking water from certain tanks, while their neighbours, getting their supply from other tanks, enjoy a perfect immunity from its infection. The villagers, living at some distance from a river or streamlet, have generally a tank each of their own ; but it is nothing but a hole on the lowland, where they bathe, wash their clothes, and get drinking water from. I have, indeed, had experience of very few epidemics in which water has not been the source of infection. As for the contagiousness of the cholera poison, I have no cause to suspect that. I have never seen an attendant contracting the disease from the patient and dying of cholera, except in the case of his being a member of the same family and eating and drinking in the same house with him. Human intercourse is a great source of spread of cholera, but the spread is always dependent on articles of food and drinking water, contaminated by the cholerine carried by persons from the affected quarters.

(3.) *Treatment of cholera.*—Under this head I will only mention the course of the treatment I have at last adopted as the best of all, after having given a fair trial to many of the so-called cholera cures brought to notice year after year. For instance, I have tried the old saline mixture, calomel, castor oil, Chapman's ice bag (frozen water being used for ice), salol, injection of morphia and atropia (combined), and so on, but none with such remarkable effect as would encourage me to recommend the drug to the public.

Now the treatment I have adopted is this : In the early stage I give three to five drops of saturated spirits of camphor (Rubinis', I prefer) every 20 or 30 minutes for a couple of hours. If the case advances towards development, and the stools and vomited matter become free from any undigested food, I give a couple of doses of chlorodyne (15 drops in each dose) after each stool. Should this fail to produce any effect, I give a mixture of acid sulph. dil., acid gallic., Tinct. Opii (in 15 drops doses, but omitting it as soon as any comatose symptoms appear) and camphor water every two hours. If any sign of sinking of the pulse appear, I give, in addition to the above, tinct. of strophanthus 3 to 4 drops, combined with 20 to 30 drops of pure brandy every 20 or 30 minutes. Here I should mention that brandy in large doses has always had effect, but in very small doses it has not. The above mixture often causes the pulse to reappear either temporarily or permanently. When this has no effect on the circulation, I have found no other drug to be of any service. After this, should the case take a favorable turn, I give very little medicine internally; but I treat the complications, if any, on general principles, taking care not to overmedicate or overstimulate the patient in any way. For thirst, I allow him to drink a mixture of acid sulph. dil. Mv and syr. lemonis one drachm and aqua one ounce, at a time, as frequently as he likes. Externally, I apply a large mustard poultice over the abdomen, but should vomiting, restlessness and thirst continue, I inject into the epigastrium about three drops of liq. morphia hypodermica, which, by sending the patient to sleep, effects a total cure in some cases (I should say in some of the mild cases), and relieves, temporarily at least, the patient from severe sufferings, in others. For the cramps and coldness of the extremities, I keep at least two attendants engaged in rubbing them with turpentine.

To prevent spread of the disease, my first step is to stop the people drinking suspected water, and then to look to other matters, such as isolation of the patient, disinfection of the patient's excreta and his surroundings with bichloride of mercury lotion, a thorough washing of the attendant's hands with the same lotion before they go to touch their food and drink, and so on.

As for diet of the cholera patient, I give him nothing but arrowroot made with water and flavoured with a little salt only ; but as he advances towards recovery, I allow him milk and mucilage of rice for a day or two, and then his usual simple diet.

(4.) *Conclusion.*—Considering the good and bad results of treatment of cholera springing up from a common origin, it may reasonably be concluded that the disease is curable, but not in all cases. It yields to treatment in the mild form, but resists it in the severe cases. Now, in the latter, the quantity of cholera poison taken in and its effect on the system must be so great and so severe that even the right remedy proves to be too weak to cope with them, just as many known antidotes of poisonous drugs prove ineffective when the poisons are taken in large quantities, and they have worked in the system considerably.

Lastly, I may mention that the preventive measures at the present moment are the best safeguards so long as a cure for the cholera of severe type is not found out.

REMARKS ON THE PARALLELISM OF THE DEATHRATE FROM FEVERS AND CHOLERA IN THE DACCA DISTRICT FOR FIVE YEARS, WITH CHARTS.

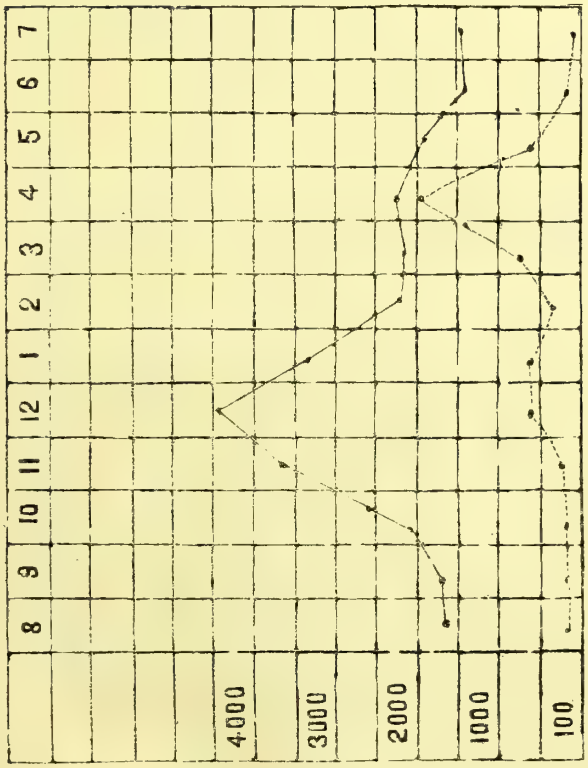
BY A. CROMBIE, M.D.,
Surgeon-Lieut.-Colonel, I. M. S.

I WISH to show the Section some diagrams exhibiting graphically the seasonal prevalence of cholera and fevers in the Dacca District. The cholera season is represented as beginning in August, the eighth month, and terminating in July of the following year. These months of July and August together with June and September are those in which the whole of the district is flooded by the annual inundation caused by the rise of the river. At that season seven-eighths of the country is under water. The maximum flooding is at the end of September, after which the water level rapidly falls, and by the end of October two-thirds of the surface of the country again emerges, and by the middle of November it is again in what may be called its normal condition as regards exposure.

During the period of flooding cholera is practically in abeyance. No epidemic prevalence ever occurs at that time, but with the emergence of the surface of the land cholera re-appears, not in one village and spreading thence, but is reported from every part of the district from villages distant from each other and evidently forming different foci. It then increases, and deaths are reported from every police thana in increasing numbers, and the maximum epidemicity is reached by the end of November and beginning of December. Cholera then declines, and the minimum is reached in February or March. In April there are in that district very frequent N-W. storms, accompanied by heavy showers. These seem to favor a recrudescence of cholera and a second maximum. In May the rivers begin to rise, flooding the lower parts of the country, and there is a distinct falling off in the prevalence of the disease. In June and July the country again becomes flooded to an extent of six or seven eighths, and cholera becomes extinct.

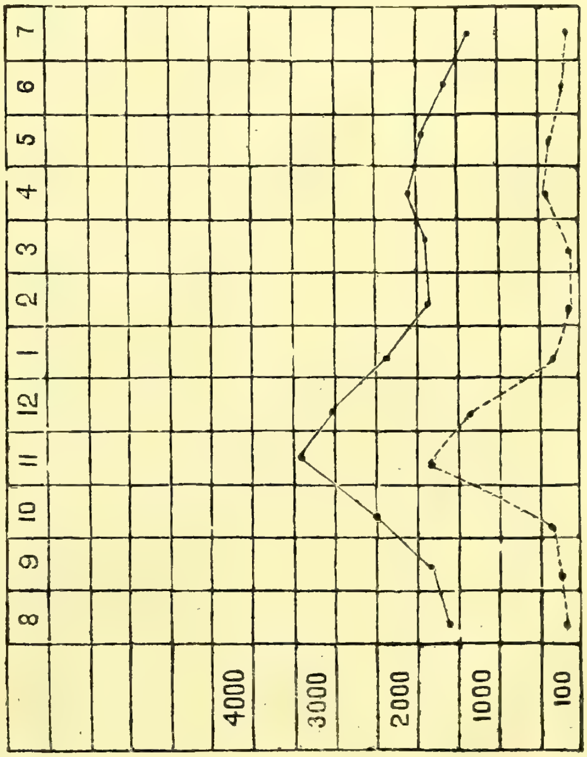
What I particularly wish to illustrate by these charts is the parallel prevalence of fevers in the same district,—a point to which I believe attention has not previously been drawn. It would therefore appear that the physical conditions, which determine the periodic prevalence of fever and therefore favor the growth of the fever organisms are also those that favor the growth of the cholera bacillus.

Chart I.



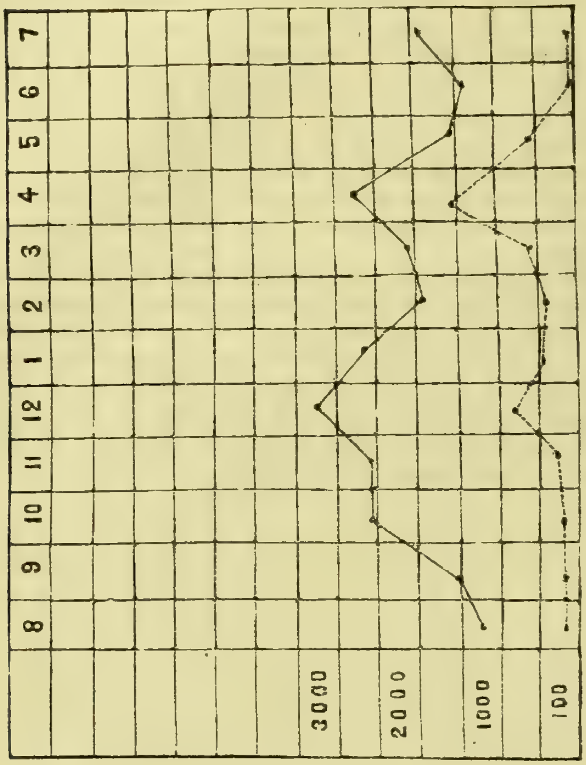
From August 1883 to July 1884.

Chart II.



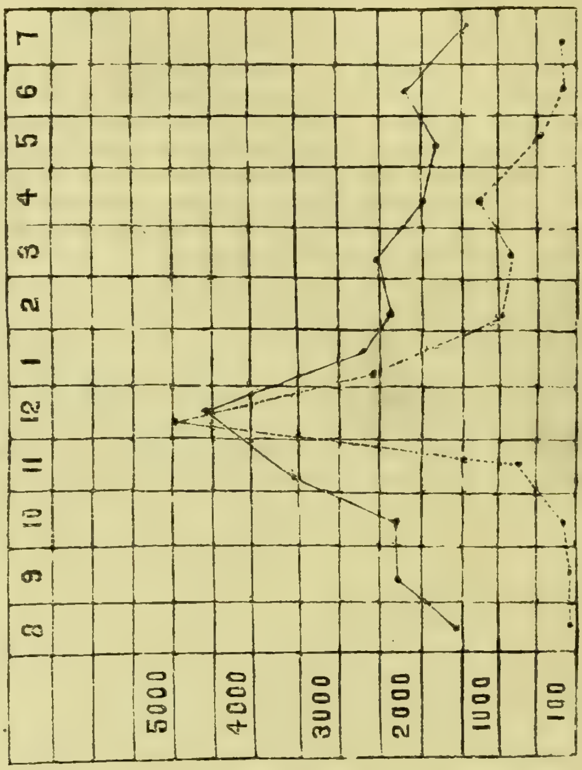
From August 1884 to July 1885.

CHART III.



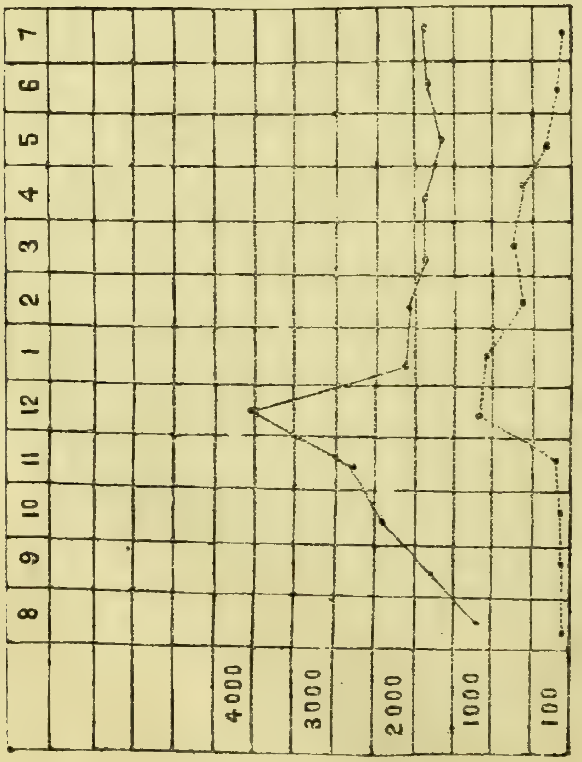
From August 1888 to July 1889.

CHART V.



From August 1890 to July 1891.

CHART IV.



From August 1889 to July 1890.

THE PREVALENCE OF THE DOCHMIUS DUODENALIS IN INDIA.

BY E. DOBSON,
Surgeon-Major, I. M. S.

Mr. President and Gentlemen,—The paper I have the honour to read before you to-day will show how very prevalent the dochmius duodenalis is in the human subject in all parts of India. To it has been attributed for years past the so-called anæmia of tea garden coolies in Assam, and quite recently my friend, Surgeon-Major Giles, has also attributed to it the so-called kala-azar or black fever of Assam. In fact Dr. Giles considers the anæmia of coolies, or anchylostomiasis, to be identical with kala-azar. I may add here that I do not agree with Dr. Giles. Any one desirous of reading all that is known about the kala-azar of Assam, I must refer to Dr. Giles' pamphlet on anchylostomiasis and the Assam Sanitary Reports for 1891, 1892 and 1893.

When I took charge of the Gauhati Jail in 1890, I learnt that 24 prisoners had been treated for anchylostomiasis by my predecessors. Of these two had died and both had enlarged spleens; of the 22 discharged as cured, twelve had been released and one transferred, so that only nine remained in jail. I gave these nine men

60 grains thymol in two 30-grain doses at intervals of 1½ hours; one of these nine was ill in hospital with malarial fever, and had a slightly enlarged spleen, but no anæmia; thymol brought away round worms and trichocephalus dispar; two others were in the convalescent gang, and were weak and emaciated, but not anæmic; one of these had a slightly enlarged spleen; thymol proved both had the anchylostoma; the fourth, also in the convalescent gang, was free from parasites of any kind; this man was emaciated, and had an enormously enlarged spleen, but was not anæmic. The remaining five were looked on as being in good health and were at work, but all had the anchylostoma in them. Of these five, case 1 had slight anæmia, was well nourished and had a normal spleen; case 2 had slight splenic enlargement, but no anæmia, and was somewhat thin; case 3 was well nourished, but had no anæmia and no enlargement of the spleen; case 4 had slight anæmia, but no splenic enlargement; case 5 had slight spleen, but no anæmia. At this time two other cases were in the jail hospital—one typical of kala-azar and the other of anchylostomiasis. In the former I found an enormous spleen, no anæmia, but numbers of anchylostoma. Death occurred whilst I was absent from the station, and at the *post mortem* only a few more anchylostoma were found. In the other case, the man was suffering from marked anæmia, and his tongue, lips and conjunctivæ were deadly white; there was also œdema of the hands and slight distension of the abdomen with fluid, but no enlargement of the spleen whatever. My predecessor had failed to find the ova of the dochmius in this case, and so did not give him thymol. Thymol given under my orders verified the fact that anchylostoma were absent, and this was further verified at the *post mortem* which occurred later on. These two cases—one typical of kala-azar in which the anchylostoma was found in great numbers without a trace of anæmia, and the other a case of intense anæmia without a single anchylostoma being found in it—led me to carry out a series of investigations in the Gauhati Jail, where the strength of the prisoners was about 200. I had only got through 67 prisoners, excluding the 11 just alluded to, when I reverted to my appointment at Dhubri, where I had especial opportunities for carrying out such investigations among the emigrant population coming into Assam from practically all parts of India. These emigrants arrive at Dhubri at four o'clock one evening and leave again by three next evening, and in every case I investigated I gave 60 grains of thymol at intervals of 1½ hours at 8 and 9-30 in the morning. It will be observed that I selected the healthiest and strongest looking of the emigrants, and as far as possible selected those belonging to different districts all over India. I also investigated the cases of all emigrants rejected at Dhubri for ill-health for whatever cause for the time being, and I also put through a similar course of treatment all peons and topazes, who had been for ten years in attendance on emigrants from the recruiting districts to Dhubri; also all clerks employed for several years in the emigration depôts at Dhubri. I similarly treated at this time all prisoners in the Goalpara and Dhubri Jails, all sick constables in the Dhubri Police Hospital and all patients in the Dhubri and Goalpara Dispensaries (that is all whose illness permitted of their taking thymol without any risk). Fifteen emigrants who had been registered in the recruiting districts and passed by medical men there as being in perfect health were also on arrival at Dhubri submitted to the thymol treatment, and in March 1894, when Civil Surgeon of Shillong, I placed every prisoner in the Shillong Jail and four recruits for the police under a similar course of treatment. The investigations are embodied in the tabular statement marked A. *(see page 58)*, which will show at a glance, not only in how many cases the anchylostoma was found by itself, or with other parasites, but will also show to how great an extent other parasites exist in the ordinary working class native of India.

Table A. epitomised showed that 58 persons were found suffering from anæmia, and 1,081 were either in perfect health or were suffering from diseases other than anæmia. Among the 58 anæmic cases the anchylostoma was found in 43, including ten cases in which it existed with other parasites; in ten cases no parasites of any kind were found, and in the remaining five, parasites of other kinds than the anchylostoma existed. Of the 1,081 persons in perfect health, we find 842 had the anchylostoma, including 190 cases in which it existed with other parasites. In 207 no parasites of any kind were found, and in the remaining 90 parasites of other kinds than the anchylostoma were found.

The following are notes regarding such of the cases in Table A. as were not in perfect health, excluding emigrants rejected for spleen and diseases other than spleen or anæmia. Of the 67 Gauhati prisoners in the above table, all but the following seven were in perfect health:—

No. 1 with slight anæmia and slight œdema of feet, but with a fairly enlarged spleen, had the anchylostoma.

No. 2 with slight anæmia, œdema of feet and a large spleen, who was also emaciated, and suffering from debility, and who eventually died of dysentery, had no parasites of any kind.

No. 3 with slight anæmia and a large spleen had the anchylostoma.

No. 4 was well nourished, had a large spleen, with no anæmia, but had anchylostoma.

No. 5 was well nourished, had a slightly enlarged spleen, with no anæmia, but had both thread worms and the anchylostoma.

No. 6 was well nourished, had slight anæmia, but no enlarged spleen, but had thread worms, anchylostoma and flukes (the amphistoma hominis.)

No. 7 was in very bad health, and was suffering from marked anæmia and swelling of feet and legs, and eventually died of dysentery; in him were found four anchylostoma and several round worms.

Among the 26 Dhubri prisoners, 23 were in perfect health, and of the remaining three No. 1 was in indifferent health, had only thread worms; No. 2 with a slightly enlarged spleen had one anchylostoma and 43 flukes (Amphistoma hominis); and No. 3 in bad health, with no splenic enlargement, but anæmic had eleven anchylostoma.

Two of the thirteen Goalpara prisoners were in indifferent health, and in one of them 25 anchylostoma

TABLE A.

RESULTS OBTAINED FROM

PARASITES.	67	651	83	10	18	15	26	13	42	58	45	22	5	46	34	4	1,139
	Prisoners, Gauhati Jail.	Healthy Emigrants on arrival at Dhubri.	Peons accompanying Emigrants to Dhubri.	Topazes and Mehters.	Clerks at Emigration Depôt at Dhubri.	District Coolies	Prisoners, Dhubri Jail.	Prisoners, Goalpara Jail.	Prisoners, Shillong Jail.	Emigrants rejected for anæmia.	Emigrants rejected for spleen.	Emigrants rejected for other causes.	Patients, Dhubri Police Hospital.	Patients, Dhubri Dispensary.	Patients, Goalpara Dispensary.	Recruits for Shillong Police Force.	TOTAL.
Tape worms	1	1	...	1	...	...	...	...	1	...	...	...	...	...	...	...	4
Round worms	1	4	2	...	1	...	1	...	...	2	...	...	...	5	1	1	18
Anchylostoma	42	417	37	2	6	12	13	4	15	33	21	13	1	20	15	1	652
No parasites	11	90	29	2	6	1	5	3	19	10	14	2	...	10	3	2	207
Round and Tricho-Dispar ...	3	...	...	...	...	...	...	...	...	...	...	...	2	...	...	...	5
Thread worms	1	28	9	2	2	...	2	...	...	2	...	2	...	...	...	...	48
Round and thread worms ...	...	2	...	...	...	...	...	...	...	...	...	...	1	...	...	...	3
Anchylo. thread and Tricho. Dispar	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	1
Anchylo. round and thread ...	...	7	2	...	1	...	1	1	...	...	...	...	...	...	4	...	16
Trichocephalus Dispar ...	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anchylostoma and thread ...	5	69	3	...	[illegible]	2	3	4	1	8	5	3	...	1	4	...	109
Anchylo. thread and tape ...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Anchylo. and small flukes ...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Anchylo. and tape ..	...	11	...	3	...	...	...	...	1	...	...	...	...	...	...	...	15
Anchylo. and round worms ...	1	13	...	...	1	...	...	...	3	2	...	2	...	9	6	...	37
Larvæ	...	1	...	...	...	...	...	...	...	1	4	...	...	...	...	...	6
Tape and round worms ...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anchylo. thread and larvæ ...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Thread and flukes ...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anchylo. and larvae ...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
Flukes	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	2
Anchylo. and Tricho Dispar ...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	1
Anchylo. round and thread large and small flukes	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anchylo. large and small flukes	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Large and small flukes ...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1
Anchylo. thread and small flukes	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Anchylo. Tricho. and round worms	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Anchylostoma, tape, thread and round worms ...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Total ...	67	651	83	10	18	15	26	13	42	58	45	22	5	46	34	4	1,139

was found, whereas the other had no parasites of any kind.

The following are the notes regarding the state of health of the five Dhubri police constables referred to in the above table:—

No. 1 had been suffering from intermittent fever for four months, spleen fairly enlarged, is decidedly anæmic, has occasional diarrhœa, which at times becomes very obstinate; six round worms and some thread worms were found, but no anchylostoma.

No. 2 had been suffering off and on from low fever for over a year, his spleen was much enlarged, anæmia was slight, there was great emaciation and weakness and occasional diarrhœa. This was a typical case of kala-azar; no anchylostoma were found.

No. 3 had been ill for a year. Fever at first, then an attack of pneumonia, after this again slight fever, diarrhœa and a slightly enlarged spleen, but no anæmia. This is also a typical case of kala-azar; no anchylostoma were found.

No. 4 was a healthy looking man, who complained only of vertigo. Thymol brought away anchylostoma in numbers.

No. 5 was admitted for slight fever. Thymol expelled numbers of anchylostoma and a few of the trochocephalus dispar.

Among the 34 patients in the Goalpara Dispensary three only had no parasites, and of these two were cases of kala-azar and one of ague. The total number of kala-azar cases was 15. Five of these had the anchylostoma alone in the following number: 2, 26, 8, 3 and 12; in four others there was one with three anchylostoma and three round worms; another with six anchylostoma and two round worms; a third with 36 anchylostoma and three round worms; and the fourth with seven anchylostoma and two round worms. In another six anchylostoma with thread worms and in another six anchylostoma with 60 large and 19 small flukes, *i.e.*, the distoma cressum and the amphistoma hominis. In one kala-azar case, 13 round worms alone but no anchylostoma were found. Two anæmia cases had 31 and 8 anchylostoma respectively. Two ulcer cases had in one of them four anchylostoma with thread worms, and in the other three anchylostoma alone. Two soft chancre cases had in one of them thread worms and four anchylostoma, and in the other 22 anchylostoma and 13 round worms. Four ague cases had parasites in only three of them, *viz.*, seven anchylostoma and 22 round worms in one, 23 anchylostoma, thread worms and two round worms in the second, and in the third eight anchylostoma alone were found. Two diarrhœa cases had 22 and 5 anchylostoma, respectively. A contusion case had six anchylostoma alone. Two bronchitis cases had 7 and 17 anchylostoma, respectively. A rheumatic case had five anchylostoma, thread worms, and 15 round worms. A case of phimosis had 23 anchylostoma. A case of asthma had four anchylostoma and thread worms, and a dysentery case had four anchylostoma and thread worms and one round worm.

The 15 kala-azar cases were typical of the disease, and the complications were more or less marked. In all of them emaciation was a leading symptom. Eleven had no anæmia, three had it well marked and one had it slightly so. The spleen was much enlarged in 14 of them and slightly so in the remaining one. There was no dropsy of any kind in ten of the cases, but it was present in the five remaining cases in the feet and face. Thirteen of the 15 cases had a distinct fever history, and in 11 of them it was recorded by the thermometer.

The 19 cases admitted into the Goalpara Dispensary for other causes than kala-azar had the symptoms usually met with under their several diseases. The two cases of anæmia were not emaciated, but one of them had slight fever. They had 31 and 8 anchylostoma respectively. One diarrhœa case had slight fever, extreme emaciation, no œdema, and had five anchylostoma. The second diarrhœa case had slight anæmia and œdema of face and feet and 22 anchylostoma. The dysentery case had slight anæmia, general dropsy, four anchylostoma, thread worms and one round worm. One of the ague cases was taken ill *en route* from Pabna in Bengal to Goalpara, and had eight anchylostoma. Regarding the 46 patients in the Dhubri Dispensary, the medical details regarding 30, which formed part of my later investigations, are available. Of these five only, *viz.*, dysentery, chancre, synovites, caries of bone and contused wound, had no parasites of any kind. Five others had round worms alone, *viz.*, one remittent fever with diarrhœa, two with malarial cachexia, one with dropsy of feet, legs and upper limbs, and one with dislocation of shoulder, and these worms were present in the following numbers: 2, 5, 5, 1, 1. A case of malarial cachexia had ten large (*Distoma crassum*) and 43 small flukes (*Amphistoma hominis*). Thread worms with one anchylostomium existed in a kala-azar case.

Ten cases had the anchylostoma by itself and in the following numbers: two anæmia with three and four anchylostoma, respectively. A kala-azar case had the ova of the anchylostoma. A case of albuminuria with ascites had 12 anchylostoma. A dysentery case had two anchylostoma. Three malarial fever cases had 1, 50, and 5 anchylostoma, respectively. A case of debility had 11 anchylostoma, and a case of malarial cachexia had 105 anchylostoma.

The following eight cases had anchylostoma with round worms: One diarrhœa had 22 anchylostoma and two round worms. Three dysentery had five, four and seven anchylostoma coupled with six, twelve and four round worms. One anæmia had five anchylostoma and four round worms. Two malarial fever cases had 22 and 24 anchylostoma coupled with 3 and 19 round worms, and one case with urinary fistulæ had 11 anchylostoma and 3 round worms.

The two kala-azar cases had no anæmia, but had greatly enlarged spleens. One had œdema of feet, but the other had no signs of dropsy. The two anæmia cases had no enlargement of spleen.

Of the 42 Shillong prisoners, 35 were Khasia Hill people, and of the remaining seven, three were Nepaulese, one a Naga, and three others were from the Dacca district in Bengal, Muzafferpur in Behar and Azimgarh in the North-Western Provinces. Of the 35 Khasias, nine only were not in absolutely sound health, and the following are the notes regarding them:—

No. 1, with slight anæmia and large spleen, had only a tape worm.

No. 2, emaciated, and with slight anæmia, and with right leg much wasted had a tape worm and five anchylostoma.

No. 3 was night blind and debilitated, had a round worm and two anchylostoma.

No. 4, with slight anæmia and ill in hospital with intermittent fever, had 14 anchylostoma.

Nos. 5 and 6 had slight spleen, but otherwise in perfect health, had 23 and 8 anchylostoma, respectively.

No. 7, with slight anæmia and a large spleen, had no parasites.

Nos. 8 and 9 both had slight anæmia, one had a single anchylostoma and the other had no parasites.

Of the remaining seven Shillong prisoners who were not Khasias, a Nepaulese and the man from Muzafferpur, each with slightly enlarged spleens only, had six and ten anchylostoma, respectively.

I admit we see a certain number of cases of intense anæmia, at times coupled with dropsy, which may be general or partial, and which we unhesitatingly say is anchylostoma or the "anæmia of coolies," but a reference to the tabular statement attached will show that, although the anchylostoma may be found in these cases, we find the parasites as frequently and in quite as great numbers in others who are absolutely healthy or have enlarged spleens or are suffering from diseases with which we know the anchylostoma can have no possible connection, and further we have the fact demonstrated beyond doubt of its existence. I might also add its universal prevalence all over India, as the emigrants arriving at Dhubri have come from Sonthal Parganas, Bankura, Midnapur, Birbhoom, Burdwan and Darjeeling, in Bengal; Bhagalpur, Monghyr, Gya, Muzafferpur, Saharan, Patna, Darbhanga, Shahabad, Raigarh, Dumkah and Motihari in Behar; Cuttack, Mourbhanj, Balasore and Puri in Orissa; Gurdaspur and Rampur in Punjab; Manbhoom, Lohardagga, Singbhoom, Hazaribagh and Palamow in Chota Nagpore; Saugor, Damoh, Bilaspur, Jubbulpore, Surguja, Rewa, Raipore, Hoshangabad, Sambalpur, Bhupal and Narsinghpur in Central Provinces; Barabanki, Ballia, Allahabad, Azamgarh, Gorakpur, Bareilly, Jaunpore, Mirzapore, Benares, Banda, Ghazipur, Etawah, Fyzabad, Maïnpuri, Fattehpur and Bijnour in North-Western Provinces and Oudh; Vizagapatam, Ganjam, Madras and Trichinopoly in Madras, and also from Nepal. And persons other than emigrants from the following places: Partabgarh and Sultanpur in North-Western Provinces and Oudh; Pubna, 24-Pergunnahs, Noakhally, Mymensingh, Rungpore, Backergunge, Dacca, Hoogly, Nuddia, Jalpaiguri and Cooch Behar in Bengal, have also been proved to arrive in Assam with the parasites in them. It also is found in natives in every district in Assam, including the Khasia Hills, where I found it in persons who had never left these hills, and whose homes were in the interior, and consequently they could not have come in contact with others from places where the anchylostoma were common. The emigrants come from their homes straight into Dhubri, after a journey of two or three days only. The indigenous population of the Dhubri district seem to have the parasite equally prevalent among them, and cases from Pubna, Backerganj and Cooch Behar clearly show that the parasite exists in the neighbouring Bengal districts. I further think the theory put forth that the Cacharis, Rabhas, Garos, &c., have got the disease, because of their going in search of work on tea gardens for some months in the year, where they mix with the imported tea garden coolies, is certainly not proved, so far as the inhabitants of the kala-azar portions of the Dhubri district are concerned. I am not aware that these people seek work at all on tea gardens in Upper and Central Assam.

My enquiries, I contend, justify the belief that it has yet to be proved that the anchylostoma is the cause of the kala-azar of this district. Even in cases of so-called anchylostomiasis is the presence of the anchylostoma in them convincing evidence that they alone cause the disease and in the way suggested? The emigrants rejected by me for anæmia, I should consider typical cases of anchylostomiasis. I find my medical subordinates consider anchylostomiasis to be anæmia without any other complication, except the anchylostoma, even though only one parasite is found; kala-azar to be enlarged spleen with no anæmia; malarial cachexia to be an enlarged spleen with anæmia; and with the result of our recent investigations before us, I cannot see that they are altogether wrong. The vital statistics for Dhubri district for 1892 show anchylostoma sub-divided under two heads—kala-azar and anæmia, and 792 and 14 deaths respectively shown under each sub-head. How this diagnosis has been arrived at by the ordinary village chowkidars I am at a loss to understand.

If Surgeon-Major Giles is right, the interesting point then is: At what stage, and when does the parasite become injurious? For I have shown how in kala-azar cases it is often not found, and, when found, is frequently in very small numbers; in true anchylostomiasis it is very often found in trifling numbers, and again in absolutely healthy persons it is found in great numbers.

Table B. *(see page 61)*, which is attached and embodies my later investigations, shows at a glance the number of anchylostoma found in each case.

Gentlemen, I take this opportunity of assuring you that I have recorded nothing but that which I have personally verified. A portion of the parasites obtained are before you now, others have been presented to the museums of the Calcutta Medical College and the College of Surgeons, England. You no doubt must have noticed that, though I have attempted to prove the almost universal prevalence of the anchylostoma all over India, I have also attempted to prove that anchylostomiasis, to which this parasite is said to give rise, is not the kala-azar of Assam, which latter I maintain is malarial fever with its sequelæ. If kala-azar is anchylostomiasis, it is a singular fact in connection with the spread of the disease that it does not come down the trunk road to any extent, where the country is comparatively free from malaria; and further in the kala-azar portions of the Dhubri district I found 21 out of 42 apparently healthy children with enlarged spleens—this organ in some cases being very large, whereas in portions of the same district comparatively free from fever I found

TABLE B.

The following Table shows at a glance how many Anchylostoma were found in each of the healthy emigrants, anæmic emigrants, emigrants rejected for enlarged spleen, emigrants rejected for causes other than spleen or anæmia, emigrants placed on contract and medically passed as healthy in the recruiting districts, depôt clerks, peons who accompany emigrants from recruiting districts to Dhubri, Dhubri Depôt, Topazes, Dhubri, Goalpara and Shillong Jail Prisoners, Dhubri and Goalpara Dispensary, Patients and Recruits for Shillong Police.

454		26	31	18	14	9	27	5	14	10	19	30	20	2
Healthy Emigrants on arrival at Dhubri.		Emigrants rejected for anæmia on arrival at Dhubri.	Emigrants rejected for enlarged spleen on arrival at Dhubri.	Emigrants rejected on arrival at Dhubri for causes other than anæmia or enlarged spleen.	Emigrants registered and medically passed as healthy in the districts of recruitment.	Emigration clerks in Dhubri Depôt.	Depôt Peons accompanying Emigrants to Dhubri.	Emigration Topazes in Dhubri Depôt.	Dhubri Jail Prisoners.	Goalpara Jail Prisoners.	Dhubri Dispensary Patients.	Goalpara Dispensary Patients.	Shillong Jail Prisoners.	Recruits in perfect health for Shillong Police.
14 had 1	2 had 38	1 had 1	3 had 2	4 had 2	1 had 1	3 had 1	1 had 1	1 had 1	1 had 1	1 had 2	2 had 1	1 had 2	1 had 1	1 had 6
39 ,, 2	1 ,, 40	2 ,, 3	4 ,, 4	2 ,, 4	1 ,, 4	3 ,, 2	4 ,, 2	1 ,, 3	3 ,, 2	2 ,, 3	1 ,, 2	3 ,, 3	5 ,, 2	1 ,, 54
31 ,, 3	1 ,, 41	2 ,, 5	2 ,, 5	1 ,, 6	1 ,, 5	1 ,, 4	6 ,, 3	1 ,, 4	1 ,, 4	1 ,, 4	1 ,, 3	4 ,, 4	1 ,, 3	......
28 ,, 4	2 ,, 45	1 ,, 6	1 ,, 7	2 ,, 7	1 ,, 6	1 ,, 5	4 ,, 4	1 ,, 15	2 ,, 5	2 ,, 5	2 ,, 4	2 ,, 5	1 ,, 4	......
20 ,, 5	1 ,, 48	1 ,, 7	1 ,, 8	1 ,, 10	1 ,, 11	1 ,, 6	1 ,, 6	1 ,, 30	1 ,, 7	1 ,, 7	3 ,, 5	5 ,, 6	3 ,, 5	......
21 ,, 6	2 ,, 50	2 ,, 8	1 ,, 9	1 ,, 11	2 ,, 12	......	3 ,, 7	......	2 ,, 11	1 ,, 16	1 ,, 7	3 ,, 7	3 ,, 6	......
25 ,, 7	2 ,, 52	2 ,, 10	2 ,, 10	1 ,, 13	1 ,, 15	......	4 ,, 8	......	1 ,, 18	1 ,, 25	2 ,, 11	3 ,, 8	1 ,, 8	......
27 ,, 8	1 ,, 53	1 ,, 12	1 ,, 11	1 ,, 18	1 ,, 16	......	1 ,, 11	......	1 ,, 20	1 ,, 120	1 ,, 12	1 ,, 12	1 ,, 10	......
18 ,, 9	1 ,, 56	2 ,, 13	1 ,, 12	1 ,, 24	1 ,, 23	......	1 ,, 16	......	2 ,, 23	......	2 ,, 22	1 ,, 17	1 ,, 13	......
19 ,, 10	2 ,, 58	1 ,, 16	5 ,, 13	1 ,, 27	1 ,, 25	......	1 ,, 26	......	......	......	1 ,, 24	2 ,, 22	1 ,, 14	......
18 ,, 11	2 ,, 60	1 ,, 21	1 ,, 16	1 ,, 29	1 ,, 26	......	1 ,, 32	......	......	......	1 ,, 50	2 ,, 23	1 ,, 23	......
13 ,, 12	1 ,, 65	1 ,, 23	1 ,, 18	1 ,, 35	1 ,, 29	......	......	......	......	......	1 ,, 105	1 ,, 26	1 ,, 81	......
17 ,, 13	1 ,, 66	1 ,, 25	1 ,, 19	1 ,, 139	1 ,, 42	......	......	......	......	......	1 ova alone looked for.	1 ,, 31	......	......
19 ,, 14	1 ,, 69	1 ,, 26	2 ,, 20	......	......	......	......	......	......	......	......	1 ,, 36	......	......
17 ,, 15	1 ,, 72	1 ,, 28	1 ,, 26	......	......	......	......	......	......	......	......	......	......	......
12 ,, 16	2 ,, 82	1 ,, 31	1 ,, 41	......	......	......	......	......	......	......	......	......	......	......
8 ,, 17	1 ,, 84	1 ,, 36	1 ,, 44	......	......	......	......	......	......	......	......	......	......	......
5 ,, 18	1 ,, 85	1 ,, 37	1 ,, 51	......	......	......	......	......	......	......	......	......	......	......
5 ,, 19	1 ,, 88	1 ,, 38	1 ,, 60	......	......	......	......	......	......	......	......	......	......	......
6 ,, 20	1 ,, 90	1 ,, 61	......	......	......	......	......	......	......	......	......	......	......	......
5 ,, 21	2 ,, 100	1 ,, 120	......	......	......	......	......	......	......	......	......	......	......	......
9 ,, 22	1 ,, 106	......	......	......	......	......	......	......	......	......	......	......	......	......
2 ,, 23	1 ,, 121	......	......	......	......	......	......	......	......	......	......	......	......	......
2 ,, 25	1 ,, 125	......	......	......	......	......	......	......	......	......	......	......	......	......
17 ,, 26	1 ,, 150	......	......	......	......	......	......	......	......	......	......	......	......	......
1 ,, 27	1 ,, 230	......	......	......	......	......	......	......	......	......	......	......	......	......
6 ,, 28	......	......	......	......	......	......	......	......	......	......	......	......	......	......
5 ,, 29	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4 ,, 30	......	......	......	......	......	......	......	......	......	......	......	......	......	......
4 ,, 31	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1 ,, 32	......	......	......	......	......	......	......	......	......	......	......	......	......	......
2 ,, 34	......	......	......	......	......	......	......	......	......	......	......	......	......	......
3 ,, 35	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1 ,, 37	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Attention is drawn to the fact that the numbers of Anchylostoma found in the cases of anæmia do not predominate over the numbers found in absolutely healthy persons.

only 15 out of 744 children with enlarged spleens, and in these latter fever was either prevalent at the time or had been so quite recently.

ANCHYLOSTOMA DUODENALE:

Is it widespread in India, Assam and Ceylon, and is it a harmless or a harmful parasite?

BY H. THORNHILL, M.D.,
Colombo.

I WOULD refer to the following extracts from Surgeon-Major Dobson's and Dr. McConnell's Reports :—

> "Even in cases of so-called beri-beri is the presence of the anchylostoma in them convincing evidence that they alone cause the disease and in the way suggested? I think not."—*Report*, 1892, *p.* 66. Surg.-Major DOBSON, *Assam.*

> "I altogether doubt the existence of any specific disease to which the term anchylostomiasis can be justly applied. * * * I maintain that it has yet to be shown that the presence of these parasites gives rise to a specific disorder or disease due, *i.e.*, exclusively or even principally, to their occurrence in any quantity or numbers in the bowel, and to which therefore the term anchylostomiasis may be applied."—*Letter* 263 *of* 29*th July* 1892. Dr. MCCONNEL, *Med. Inspector of Immigrants, Calcutta.*

The opinions of these two officers appear to have had more weight with the authorities than that of the very large number of medical men—official and private—in this and other countries, who hold, and have expressed, a different opinion.

It is therefore a matter of the utmost importance, from a public health point of view, that these questions, which may concern the health, and hence the labor and life of thousands, nay millions, of the inhabitants of India, Assam, Burmah, and Ceylon, should be carefully considered by the members of this Medical Congress, and if they are not prepared to endorse the opinion that it is a harmless parasite, that they should say so with no uncertain sound, and that they should record what steps should be taken to limit its spread and to mitigate its effects.

Is it possible, after the experience of the havoc caused by this parasite amongst the St. Gotthardt Tunnel workers, amongst the brickmakers at Cologne, in Brazil, Japan, Cochin, Borneo, Egypt, &c., and after all that has been written on the subject by Dubini, Griesenger, Bilharsz, Wencherer, Lutz, Leichenstein, Sousino, Hirsch and many others, to now doubt that a specific and fatal anæmia is caused by this parasite *when present in large numbers for a sufficient period of time?* Is it possible for anyone who has seen the parasite and admits that it is a *blood-sucking leech*, and who has ever, at a *post mortem* in a case dead from anæmia, seen them in hundreds fixed to the intestinal walls by their teeth so firmly that it requires some force to pull them off, and who has seen their recent bites on the intestinal walls, and the scars of what manifestly are old bites—is it, I ask, possible for any such person to argue that these are *harmless intestinal parasites?*

I propose therefore to ask this Congress to express its opinion as follows :—

(1.) The anchylostoma, or dochmius duodenale, is one of the most harmful and dangerous of human parasites.

(2.) When present in the intestines in large numbers and for a certain period (both of which may vary in inverse proportion to each other, and in proportion to the presence or absence of other parasites, diseases or states) it produces a specific and dangerous anæmia.

(3.) This anæmic state should be known in future by the name "anchylostomiasis" so as to distinguish it from true beri-beri, which is characterized by the presence of neurotic symptoms.

Gentlemen, if you agree with me that this is not a harmless but a baneful human parasite, I will now invite your attention to the evidence that exists as to its widespread distribution, and to the harm it does by its destruction of life and labor.

That it is widespread in India and Assam is amply proved by the two distinguished officers I have quoted from. Surg-Major Dobson examined the fæces of 1,249 natives of India who came from 35 districts of 9 provinces, and he found the anchylostoma present, though only *in small numbers*, in 944, *i.e.* in 75·58 per cent. of them : Dr. McConnell, in his most interesting article in the *Lancet* of July 1882, also demonstrated its extensive prevalence in India : Surgeon-Major Giles, Surgeon-Major Neil Campbell and almost all the Assam medical officers have shewn how widespread the parasite is on tea estates and also to a lesser extent amongst villages in Assam (*vide* Assam Report, 1892, pp. 99 to 108).

As regards Ceylon, Dr. Kynsey, the Principal Civil Medical Officer, in his Special Report of 1886 on "Anæmia or beri-beri of Ceylon" (an unfortunate term) and in his pamphlets and Annual Reports of the years since, has shown how prevalent it was, and is. Dr. Macdonald in the Ceylon Medical Journal has done the same in his footnotes to his translations of Lutsz, Leichenstein, Eichorst, Erni, &c., with which he has favoured us, and for which we in Ceylon owe him much thanks, and the Ceylon Medical Report for 1893 shows 1,760 treated in the various hospitals (with 395 deaths) and 2,364 cases treated at the dispensaries.

These Ceylon numbers I am aware are comparatively small, but it must be remembered that there are undoubtedly provinces and districts where the parasite and its consequent anæmia are not to be found, at least extensively, and also that many medical officers still return cases of this disease as malarial cachexia, diarrhœa, debility, anæmia, dropsy, &c., according to the most prominent symptom, but without having examined the fæces for anchylostoma ova or adult parasites, and in many cases without reflecting or knowing that the cause of these symptoms might be referred to the presence of this parasite.

The presence of the anchylostoma is not yet sufficiently examined, for in cases where marked anæmia is present, or its existence would, I am satisfied, be much more frequently recognised as a cause of that anæmia. From September 1892 to the end of December 1893 I caused the fæces of all cases where there was marked anæmia, treated in the hospitals of the Uva Province (population 160,000) of which I then had charge, to be examined with the microscope for ova, and we found the anchylostoma in 783 cases in such numbers as, combined with the state and condition of the patients, warranted us in diagnosing and returning the cases as anchylostomiasis.

I am satisfied that the parasite is equally if not more prevalent in other provinces of the island, especially in provinces where immigrants from India are employed on tea estates.

It must not, however, be imagined that the parasite and its resulting anæmia are confined to immigrants from India. Whether the disease existed amongst the Sinhalese in past times or not, I can only say that it is now widespread amongst them in the Uva and other provinces of Ceylon, apparently mostly in the provinces where immigrants from India are employed, for instance amongst the 783 cases alluded to above the nationalities were—

European and Bengher	Nil.
Sinhalese	231
Ceylon Tamils (Indigenous) ...	45
Immigrant Tamils (Estate Labourers)	470
Moors	35
Malays	1
Others	1

The age and sex distribution of these 783 cases were—

Adults ...	665	Males ...	572
Children ...	118	Females ...	211

I also examined the fæces of patients under treatment for other diseases, and found the anchylostoma in a considerable number of them.

Dr. Sandwith in his pamphlet written for the 1894 Medical Congress at Rome, and which is published and reviewed in the July Number of the *Indian Medical Gazette*, and Sousino in his article in "Davidson's Diseases of Warm Climates" have shown how prevalent and destructive the parasite is in Egypt, a country in which it is estimated that one-quarter of the population is seriously affected by it, and where Dr. Sandwith says that it is "sapping the life of the peasant class:" he states also that 3·3 per cent. of the *adult* males of Upper Egypt and 6·2 per cent. of those of Lower Egypt, *i.e.*, 9·5 per cent., were rejected as being unfit, from *advanced anæmia*, to serve in the army, adding the remark "the recruiting officer who is an Englishman only rejects those who are obviously too anæmic to serve with the colours, accepting many who are already the hosts of the blood-sucking worm," and he shows that in one province, Menonfieh, as many as 13·9 per cent. of the adult males were rejected for this anæmia.

From my own experience of the prevalence of the parasite amongst the women, children and *aged males* in Ceylon I feel satisfied that the percentage of rejections amongst the adult Egyptian males if *doubled* would certainly not overstate the percentage of cases amongst the entire population.

If these figures represent the numbers of *advanced* cases only, it can be imagined what the numbers must be of cases in the primary and less advanced stages, and hence how prevalent and destructive of health, life and labor the parasite is in Egypt.

Drs. Dobson and McConnell have shown that the parasite is very prevalent at least in certain districts and provinces of India. Giles and the Assam medical officers have shown that it is as prevalent amongst the tea estate coolies in Assam, and that it is not unfrequent amongst the villages of Assam in the vicinity of estates, and at page 66 of the Assam 1892 Report Dr. Dobson says: "The indigenous population of the Dhubri District seem to have the parasite equally prevalent amongst them," and the Ceylon Returns and Reports show the same prevalence amongst the estate labourers and villagers.

Even if it can be shown that it is not *at present* equally as prevalent or destructive to life and labour in India, Assam and Ceylon, as it is in Egypt, is there any reason to conclude that it will not become so, unless steps be taken to limit its spread, and is it not therefore the duty of this large and important Congress to urge on the Government the necessity for such steps being taken and to indicate what those steps should be? In this connection I wish to quote the words of the *British Medical Journal* of 7th October 1893 when reviewing Dr. Dobson's remarks as published in the Assam Reports and in the *Indian Medical Gazette* of December 1892, and January, February, March and August 1893. It says:—

> "But we submit that the anchylostoma is not the innocuous parasite Dr. Dobson's remarks tend to make it out to be; that, on the contrary, as the researches of many able men in Egypt, Europe and America have established, it is the cause when present in large numbers, and in particular circumstances of a distinct disease, and that it is a powerful contributor to the mortality in such countries as India. * * * We think therefore * * that he goes too far in minimising the pathological *rôle* of anchylostoma duodenale, and we trust that his views on this point may be received with caution and may not be allowed to interfere with the prophylactic and therapeutic measures his researches so plainly indicate."

I wish too to make some remarks on Dr. Dobson's figures and statements in the Assam Report for 1891 and 1892. In that for 1891 at page 52 he says: "These results were astounding, as they prove beyond doubt how very extensively the anchylostoma is distributed over India *and with practically no bad results.*" And at page 63 "where 65·38 per cent of the cream of the imported population is literally teeming with the parasite," and on same page he asks, "why should not the anchylostoma prove equally fatal in other parts of India?"

On these I would remark that Dr. Dobson was dealing in Assam only with these immigrants from India who had left their villages and were on their way to Assam to labour on estates. He saw therefore only those who, when they left their homes, were well enough to travel. I do not say that he infers, but it is certainly left open, at least for the uninitiated, to infer that the coolies he inspected represented the average state of health, as regards effects from this parasite, of all the inhabitants of the villages in India from which they came. I submit that this is misleading. I submit also that the more correct and reasonable conclusion is that in the villages, where these infected immigrants came from, there were many other cases affected with the parasite, and hence as they were living in an infected area, some, more probably many, were, or would soon be, infected with larger numbers of the parasite, and that they either had, or would soon reach that stage of infection when, from large numbers or from long residence in their intestines of smaller numbers, the characteristic anæmia and debility had, or would appear, and I cannot but think that had Dr. Dobson followed up his researches by proceeding to some of these districts and villages of India from which these "healthy coolies," these "cream of the population," came, he would there have found numbers in far advanced stages of anæmia and debility, and in them not 5, 10, 50, 100 or 150 anchylostoma, but hundreds or thousands, and abundant evidence of the bad results, *viz.*, such sickness and mortality as all experience shows does result from them.

In the Assam 1892 Report he says at page 66: "In true beri-beri (he is here talking of anchylostomiasis) it is often found in trifling numbers, and again in absolutely healthy persons it is found in great numbers."

With regard to the first part I would remark that Dr. Dobson should have quoted actual cases and given their medical history and particulars as to the number of examinations made of their fæces, and whether his remarks were based on estimation of the numbers of the parasites present from microscopical examination of the fæces for ova, or on the finding of parasites in the fæces after only one administration of thymol. However, even supposing that his examinations were often repeated, even in a fair number of bad cases, still this would not warrant a conclusion that the condition was not due to the anchylostoma, for it is well known that the severity of the symptoms in many cases bears no relation to the number of the parasites present *at any particular time*, and that the number of the parasites found to-day gives no indication as to what numbers were present previously. This has been adequately proved by Lutz, Leichenstein, Giles and others.

With regard to Dr. Dobson's remarks and his tables giving the results of the examinations of hundreds of healthy looking coolies, and other persons, and the finding in them of anchylostoma, I would remark that in the vast majority of the cases he gives the numbers of the parasites present as under 50, a number altogether too small to have any deleterious effect. In many others the numbers range from 50 to 100, and in only seven do the numbers reach or extend 100. I will, however, admit that had the numbers been estimated from the ova, or had these cases been treated with thymol more than on one day, or had the fæces been examined in the first, second and third days after the thymol, much larger numbers of the parasite would have been found. Yet I say that Dr. Dobson is not justified in inferring, or in asking the authorities to infer, as apparently he does, that because these coolies appeared healthy, notwithstanding the presence of the parasites even in large numbers (100 to 230), that therefore these parasites are harmless, for he has omitted to state or to take into consideration *the length of time during which these parasites were in the intestines of these coolies.* Surely it is manifest that two points must be carefully determined and considered, *viz.* :—

(1) The minimum number of parasites that will cause any symptoms after a *protracted* sojourn in the intestines.

(2) The length of time in the intestines that is necessary for even a large number of the parasites to produce anæmia or other serious symptoms.

Lutz—*vide* page 30 of Dr. Kynsey's monograph—says : "Should the patient on exposure be slow in acquiring the disease (*i.e.*, the parasites) the number of the anchylostoma may for a considerable time be limited and their presence give rise to no symptoms whatever. * * * It may be said that adults in the absence of any complication, and in whom the disease runs a tolerably quick and uniform course, do not begin to show symptoms until the number of anchylostoma passes into the hundreds, so that when pronounced general symptoms are present. 300 to 500 parasites may be set down as present in the duodenum. In severe cases I have not found over 1,000 present, but in the Gotthardt Epidemic 2,000 and even 3,000 were found."

Leichenstein—*vide* Ceylon Medical Journal, January 1892, pages 9 and 14—gives a case of a man, Freischmidt, who died of phthisis exactly four weeks after he was infected with anchylostoma, and in whom 253 were found *post mortem*, yet he says "the patient who died of phthisis pulmonum never had any intestinal symptoms and no signs of any special anæmia," and Giles makes similar remarks in the *Indian Medical Gazette* of July 1892.

I submit therefore that no inference as to the harmlessness of these parasites can be drawn from Dr. Dobson's cases, nor from any cases, even when hundreds, say even 500 or more, are proved to be present, *unless it be shown that they were present for a period of, I should say, 6 to 12 months at least.* I submit it is manifest that small numbers may be present even for long periods, and large numbers for short periods, without causing serious or any symptoms, though of course the effects produced will vary according to the state of health of the host, *i.e.*, even a small number may produce serious symptoms, even in a short time in an already debilitated host.

Dr. Dobson's figures, however, do show that the parasite is most widely distributed, and thus shows that these large numbers of persons affected with it had been, were, and would be, a source of danger to others, as they were sowing the ova of this parasite, whereby others would be infected or themselves still further infected, for no matter how few parasites are present in any one, such person's stools must contain thousands of the ova, and if they passed their stools on the surface of the ground, as no doubt Dr. Dobson's apparently healthy coolies did, they were undoubtedly sporading the parasites to others, and of course those left behind in the villages were doing the same.

PREVENTION.

Gentlemen,—If you agree that this parasite is harmful and that it is widespread, and that it is at present causing great misery and impoverishment by widespread destruction of life and labor, you will also, I think, agree that it is incumbent on you to say whether any further steps should be taken by Government to mitigate its ravages and to limit its spread.

In his opening address to the 1891 International Congress of Hygiene—*vide* page 12 of Vol I. of the Transactions—the illustrious President H. R. H. the Prince of Wales said : "Where is there a family in which it might not be asked, 'if preventible, why not prevented ?' I would add that the questions before the Congress, in which all should take personal interest, do not relate only to the prevention of death or of serious diseases, but to the maintenance of the conditions in which the greatest working power may be sustained." At page 30 of the same volume Sir J. Fayrer says : "Preventible disease still kills yearly about 125,000, and considering the large number of cases for every death it has been calculated that 78¼ millions of days of labor are lost annually, which means £7,750,000 per annum." At page 343 of the same volume Dr. Sousino writes : "Thus in conclusion anchylostoma, filariæ and bilharzia are veritable scourges to mankind—scourges of a kind that do not destroy at once like cholera or plague, but decimate slowly and deteriorate entire populations like malaria. To these scourges particularly I wish to call your attention with a view to deriving means for their prevention."

In his article on anchylostomiasis, translated by Dr. Macdonald and published in the April 1890 number of the *Ceylon Medical Journal*, Dr. Sousino says : "I do not exaggerate in saying that it is a social plague, only second to malaria and pellagra. Fortunately in the gravest form it is limited to certain workers

It is also easily dealt with and may be prevented by simple means. I may also say that it would not be impossible to destroy the foci altogether; let us do what lies in our power to attain this object and I request your valuable assistance in this direction. Do not consider me a revolutionist if I say to you that in every free country, the leaders of the State are guided by public opinion, and in this case who can interpret (influence ?) public opinion better than a society like ours."

In my Report for the year 1893, printed at page 15 of the Ceylon Medical Administration Report, 1893, I wrote:—

The prevalence of *anchylostomiasis* is not to be judged of by the comparatively few cases (*viz.*, 66C) that have been seen and have been recognized and treated as such at the hospitals and dispensaries during the year: it is only when in the advanced stages of the consequent anæmia. dropsy, diarrhœa, or general debility that those suffering from this disease come for treatment.

I am satisfied that this disease as regards extensive prevalence and destruction of life and labour is second only to malarial fever, and that it is in a way almost more important, as it is extensively and most prevalent in places comparatively free from malaria, *i.e.*, such places as estates and bazaars and the larger villages, where the greatest number of people are resident, *i.e.*, in the higher portions of the province and the less malarious places to which people have gravitated to escape from the deadly malaria of the low-country.

It may therefore be said that malaria (in most cases combined with anchylostomiasis) is the terribly destructive and depopulating disease of the sparsely populated low-lying unhealthy divisions, and that anchylostomiasis takes its place, and is almost equally prevalent and destructive in the higher portions of the province which are comparatively free from malaria.

With regard to the prevalence of and loss of life and labour caused by anchylostomiasis (*dochmius duodenale*), and the measures necessary and desirable to check same, I would refer to my evidence printed at page 38 of the 1893 Cooly Mortality Commission Reports, and at page 18 of the Principal Civil Medical Officer's 1892 Report. I think it is time that some real action was taken to check the widespread destruction of life and labour due to this preventible cause. The writing and printing of reports will not do it: this has been done; it is now time they were acted on, and the only effectual method adopted, *viz.*, the prevention of the pollution of the ground about dwellings on estates and in towns and villages by the provision and proper cleansing of sufficient and suitable latrine accommodation being rendered obligatory, and by their use being insisted on, the committing of nuisances being rendered penal and being punished.

In proposing any measures, we must remember the ignorance and prejudices of the people who are to be benefited, but we must not allow these to become a bogie to deter us, or have recourse to them as a convenient cant phrase to cover us in shirking the difficulty of tackling and dealing with this question. The sanitary and other measures which all recommend should, however, be the very minimum that science, reason and experience indicate as necessary to limit the spread, and mitigate the evils of this terrible disease—a disease in comparison with which I believe that cholera sinks into utmost insignificance, for it is *always* present, not like but with the poor, so that the expense to Government and the interference with the people and their habits may also be the minimum actually necessary.

Whether there be a rhabelitic stage or not, whether the larvæ are introduced into the intestines, directly from the soil or from water, matters little as regards the steps that should be taken to prevent the spread of this parasite. If the infection is caused chiefly from the water (which I do not think it is), then as the water is infected from the soil, the proper step is to prevent the soil being infected; similarly, if the infection is direct from the soil, either by encysted larvæ in the full stage, or by the parasite in a rhabelitic stage, the only possible step is to prevent the fæces of persons infected with the parasite being scattered over the surface of the ground. This can be done only by the use of latrines.

French latrines I fear are not suitable either for villages or for estates. They do well enough for an army on the march, or for temporary gatherings of people, but I doubt much if they would do for a fixed and permanent population. The space required would be too large to admit of their being put and kept sufficiently near to the houses of those who would be expected to use them, nor is it reasonable to think that the trenches would be covered over daily with earth, or that the fæces, especially of children, would be passed into them alone, and not on their edges or on the ground round about them. I fear, therefore, that "French latrines" and "enclosed spaces" are useless for villages or estates, or even worse, for if adopted they would, I fear, merely lead to a concentration in their neighbourhood of anchylostoma ova and larvæ, which would simply still more ensure that the larvæ, or rhabdities if they exist, would be carried on the feet of the frequenters, and of fowls, dogs, &c., into the houses of the inhabitants, and during rainy weather the contents of the trenches would surely be washed out on to the surrounding ground, and possibly into the water supply.

The ordinary permanent bucket latrines are too costly in construction and in maintenance for us to expect that they could be widely adopted for villages, to say nothing of the supervision and staff of latrine coolies they would require to ensure that they were kept clean and fit for use.

The only alternative is the pit latrine. I am aware how undesirable cesspits are, but in this case it is simply a question of "of two evils choose the least."

I have lately advised the introduction of pit latrines on tea estates in Ceylon where this disease is prevalent in an appendix. I give a sketch of the latrine, which is simply a long, narrow, deep pit, with old railway rails, and iron footplates over the top. This plan and my remarks regarding it and the necessity for it have been printed and are being circulated by the Ceylon Government to tea estates.

Similar pit latrines should be constructed by Government in sufficient numbers at all villages and hamlets, or at least in all villages and hamlets where cases of anæmia, possibly due to anchylostoma, were found.

If these latrines were constructed in sufficient numbers so that they would not involve too much trouble to the inhabitants to go to them, and if kept clean, which can easily be done as no daily emptying is required, I have no doubt they would be largely availed of. I do not expect that they would be universally used, but if only one-half, or even only one-quarter of the inhabitants use them, surely even this would be an enormous improvement and advantage, and would to that extent limit the spread, not only of this, but of other diseases, such as cholera, typhoid fever, &c.

The people should be led and induced, rather than compelled, to use them. Power should, however, be created to punish anyone found committing a nuisance within hundred yards of his own or of any other house, and also to punish the owner or occupier of any land, within hundred yards of any house found habitually polluted with human fæces, *but such powers should seldom be used.*

It is needless for me to say that the water-supply, at its source along its course and where delivered, should be protected from pollution, but I do think that even still greater efforts should be made to induce the natives to boil all water before drinking, as such would be beneficial, not only as regards the prevention of parasitic diseases, but also of cholera, malarial fevers, filariasis, &c.

Sousino at page 342, Vol. I. of the 1891 Congress of Hygiene, recommends:—

> "Microscopical examination of the fæces in the case of workmen before their admission into such works as tunnels and mines,—an examination which must be repeated at regular intervals in order to eliminate from these places of labour those that are found infected, and to cure them before re-admission."

> Sandwith, at page 25-26 of his Pamphlet, says: "Lastly, the Government, especially with its recruits for the army, the police and public works labour, might have all peasants examined more carefully than is at present done for the early symptoms of the disease. Early cases of anæmia can be recognised by a doctor before the patient is aware that he has a definite illness, and one dose of thymol can prevent the chronic pernicious anæmia which drags a man to the hospital one, two or three years after he begins to feel ill."

All recruits for the native army and police, and all Government coolies and native employees of all kinds, all children in Government schools, all estate laborers and factory hands, should be examined carefully for anæmia, and if it existed in any marked degree all sufferers should be detained and their fæces be examined with the microscope for ova, and if found then the village or possible place of infection should be registered, and each such person should either be detained for treatment or be furnished with a ticket, which should ensure that treatment would be carried out either *en route* or at his destination.

Inspections should be made as far as possible of the inhabitants of these villages, and if cases of anæmia were found the sufferers should be similarly examined and treated, and pit latrines should be constructed, and special steps taken to ensure that the sufferers at least did use them.

Numerous dispensaries, to be placed in charge of subordinate officers specially made familiar with this disease, and the use of thymol and male fern, should be opened, even temporarily, in all villages and places *known to be centres of this disease*, and the inhabitants should be urged to have themselves treated, and it should be made a condition of continued employment with all Government native employees, and with all estate and factory hands known to be infected, that they *did* submit to the treatment.

In this connexion I would wish to add a few remarks regarding the difficulties and dangers of treatment by thymol and male fern. I annex tables giving the results in 327 cases of this disease that were treated under my immediate observation either with thymol alone, or with male fern or with both (given of course on different days).

The first thing that strikes one is that the anchylostoma may survive even many doses of these drugs. Thus it will be seen that the ova were still found in 47 cases even after 4 doses, in 29 after 5 doses, in 22 after 6 doses, in 8 after 7 doses, in 6 after 9 doses, in 5 after 10 doses, in 4 after 11 doses, in 3 after 12 doses, in 3 after 14 doses, and in 1 after even 16 doses.

As no case was marked as *cured* until no ova were found in the fæces on careful examination on at least four different days, the recorded results may be regarded as fairly accurate as a test of the relative efficacy of the drugs: 103 of the 327 cases were discharged as *cured*, and these 103 had been treated as follows:—

With Male Fern alone	40	*i.e.*	32·90	cured.
„ Thymol „	32	„	27·58	„
„ Mixed, *i.e.* with both,	31	„	35·63	„

These figures would indicate that alternative doses of the drugs would ensure the best results, and that male fern is superior to thymol; the results however are too close to gather to furnish data for preferring one drug to the other.

Thymol is a most disagreeable drug; its horrible taste and the burning, excitement, giddiness, fainting, and even vomiting which it not unfrequently produces, render patients loath to take it, and in fact many absolutely refused to do so, and would I am sure have left the hospital rather than do so; it is besides dangerous. Leichenstein records one case of fatal collapse after it. Sandwith records two, Dobson one or two, and I must now add three fatal cases of this record, though in each case the patients were in hospital, and I know were closely watched and every precaution taken, none being far advanced cases or in which there was any reason to suspect that thymol would be exceptionally dangerous.

I would wish to add a word of caution regarding the administration of thymol in spirituous solutions, and as to the giving of brandy or other spirits shortly after its administration. One of the fatal cases was a man who had received 30 grains of thymol suspended in water at 7 A.M. He experienced no special symptoms after it, and at 9 A.M. the nurse gave him the second dose of 30 grains. As this man was supplied with arrack as an extra, and as in such cases a portion of the arrack was usually given at 9 A.M., the nurse gave it to him just after giving him the second dose of thymol. The result was that intense collapse set in almost at once, and notwithstanding all efforts the man died within 24 hours, the collapse manifestly being due to the arrack dissolving the thymol, which was thus absorbed.

Male fern is certainly a most disagreeable medicine, but my experience is that it is less objected to than thymol, and that the giddiness, fainting, vomiting and collapse which it produces are milder and far less frequently produced by it than by thymol.

It is much to be hoped that some less dangerous and disagreeable but equally efficacious drug will be discovered for the treatment of this disease, *i.e.*, such a drug as could safely be sold or issued to the public and to superintendents of estates for use in these cases. Dr. Braddon, of the Straits Settlements, suggests oil of peppermint. Dr. Schokman, of Ceylon, says he used kerosine oil in 30 drop doses twice a day in mucilage with marked success in *one* case, and Dr. Macdonald *suggests* that carbonate of guiacol *ought* to be efficacious. All are worthy of a trial.

I attach a summary showing the chief signs, symptoms, and complications observed in 783 cases of this disease :—

TABLE OF PROMINENT SYMPTOMS & COMPLICATIONS.

	On admission.
Emaciation or General Debility ...	557
Earth, Brick, or Tile-eating	75
Diarrhœa	516
Constipation	212
Blood in motions	43
Skin yellowish-green	120
Conjunctivæ and Scleræ pale	448
Do. rusty or blackish	214
Tongue and Palate pale	384
Do. with black patches	85
Finger Nails pale	403
Œdema of Eye-lids and Face	109
Do. of Extremities	289
Ascites	40
Formication	82
Numbness of Extremities	92
Burning of Palms or Soles of feet ...	213
Malaria...	239
Phthisis	13
Chronic Indolent Ulcers	124
Epistaxis or other Hæmorrhages ...	42
Spleen enlarged	144
Dimness of Sight, night blindness ...	75
Skin Dry and Harsh	21
	...
	1

Table shewing the number of doses of *Male Fern* or *Thymol* or *both* that were given to cases *including* all the *cases* that died (but *excluding* 53 *cases* that *had no specific treatment*) because the *ova* were still found in the fæces after the *previous dose.*

NATURE OF SPECIFIC TREATMENT.	TOTAL NUMBER TREATED. Number of Doses.																				Total treated with each specific Drug.	Percentage of total Treated.	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	1	19	20			
Male Fern	55	33	16	7	3	2	5	1	...	...	...	...	...	...	1	...	1	...	...		124	37·92	
Thymol	57	39	13	5	1	1	..	...	...	...	...	...	...	...	...	...	...	...	...	...	116	35·48	
Mixed	..	25	19	13	14	4	5	3	...	2	...	1	...	...	1	...	...	...	..	...	87	26·60	
GRAND TOTAL ...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	327	......	

NATURE OF SPECIFIC TREATMENT.	TOTAL NUMBER CURED. Number of Doses.																				Total treated with each specific Drug.	Percentage of total treated and cured.	Percentage of total cured.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Male Fern	16	11	6	2	2	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	40	32·90	38·83
Thymol	11	11	6	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	32	27·58	31·06
Mixed	...	9	8	4	6	1	1	...	...	1	...	1	...	...		...	...	...	...	..	31	35·63	30·09
TOTAL ...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	103	......	......

NATURE OF SPECIFIC TREATMENT.	TOTAL NUMBER RELIEVED AND NOT IMPROVED. Number of Doses. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total treated with each specific Drug.	Percentage of total treated and relieved and not improved.	Percentage of total relieved.
Male Fern	27	16	8	5	1	2	3	...	...	...		...	...	...	1	...	1	...	...	...	64	51·93	34·97
Thymol	32	25	6	1	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	65	56·03	35·51
Mixed	...	15	11	9	7	3	4	3	...	1	...	...	...	1	...	...	...	...	...	...	54	62·07	29·50
TOTAL ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...		...	...	...	...	...	183	......	......

NATURE OF SPECIFIC TREATMENT.	TOTAL NUMBER DIED. Number of Doses. 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total number that died.	Percentage of total treated and died.	Percentage of total died.
Male Fern	12	6	2	...	...	...	...	...	...	...	.	...	...		...	...	...	...	...	...	20	16·13	48·78
Thymol	14	3	1	...	...	1		...	...	...	...	...	...	...	...	...	...	...	...	...	19	16·38	46·34
Mixed	...	1	...		1	...	...	...	...	...	...	...	...	...	...		...	...	...	...	2	2·29	4·87
TOTAL ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	.	...	41	......	......

SOME REMARKS ON ANCHYLOSTOMIASIS AND ITS CAUSATION.

BY J. D. MACDONALD, M.D.,

Ceylon Government Service.

When I took charge of the Colombo General Hospital some ten years ago, I found under treatment a number of cases, the main symptoms of which were extreme anæmia accompanied by more or less dropsy. In many of these cases I could not say that malaria had any great share in the production of this condition, whilst in others, the effects of malaria were so apparent that there was no necessity to seek for any other cause.

Cases of the kind were familiar to me prior to this in hospitals of the coffee districts of the Island, but it never occurred to me that the disease, characterised by extreme anæmia, was in any way connected *re* causation with the well-known outbreak at the St. Gotthardt Tunnel, which was traced by the Italian physicians to the presence of large numbers of the anchylostomum duodenale in the intestines of the patients, and which Perroncito in particular investigated with such signal success that very little has been added to his work in this respect by other investigators in the same field of research. The possible causation, the anchylostomum duodenale was suggested to me by W. R. Kynsey, Esq., C.M.G., the Principal Civil Medical Officer of Ceylon, and I very soon found that this parasite was indeed the cause or main cause of the anæmia in a large number of the cases under treatment. I may take this opportunity of correcting a very prevalent idea, *viz.*, that Mr. Kynsey was under the impression that anchylostomiasis and beri-beri were one and the same disease. This is not so. Mr. Kynsey was perfectly well aware that every trace of true beri-beri had disappeared from Ceylon many years prior to the date of his writing his memorandum "Anæmia or Beri-Beri of Ceylon." The heading no doubt gave rise to the erroneous idea, and as error dies hard, I consider it necessary to make mention of it here. Cases of true beri-beri still appear occasionally in the returns of the Colombo Hospital, but they are cases landed from passing steamers, and not cases existing in the Island. I had two such cases myself under treatment in the General Hospital, and I had thus an early opportunity of differentiating this disease from that which I was now called on to investigate. I very quickly found the ova of the anchylostoma in the stools of the patients, and had ample opportunities of observing the parasite itself *in situ* post-mortem, and noting the condition of the mucous membrane of the intestine consequent on its residence there. At this period there was scarcely anything to be found in English Medical Literature on the subject, and I had to turn to German, French, and Italian authors for information. The monograph of Dr. Adolph Lutz, which appeared some time previously in Volkmann's Collection, was the first to fall into my hands, and was of great service to me. The treatment being of paramount importance first engaged my attention, and an indication of this was also given by Lutz. I at first tried the effects of the ordinary anthelmintics, but without success. Male Fern is undoubtedly good, but I did not administer it in my first cases in sufficiently large doses, to note the efficacy which follows comparatively large doses—and to obtain any good results it must be given in large doses. I therefore gave exclusive preference to thymol, and, although this drug has not proved an absolutely safe remedy in the hands of many others, I must say that the many hundreds of cases in which I administered it myself in large doses, up to 60 grains and over in cases of adults, and 30 grains in the cases of children, I never had a mishap from it, beyond a sensation of heat in the pit of the stomach, and some amount of giddiness, which however always passed off without any bad results. I do not however consider thymol a safe drug in the hands of the inexperienced nor suitable for routine treatment. Lately I have been in the habit of prescribing the carbonate of guaiacol in cases of phthisis, and I have had occasion to note its anthelmintic properties. I have had as yet no opportunity of trying its effects on the anchylostomum duodenale, but I throw out the suggestion in case any of you might be inclined to give it a trial. I scarcely think a single dose of it would be efficacious. I would be inclined to try it as a routine treatment of 8 grains three times a day for several days. A routine treatment of this kind is necessary, if the patients are to be treated at out-door dispensaries, and very little impression can be made on the disease at large, unless this is possible. The treatment in general is now so well known that I need not further refer to it here.

The life history of the parasite had the greatest interest for me after the treatment, and I carried out investigations extending more or less over 6 years to determine this. Let me hasten, however, to inform you that I was not able to add anything to what had already been discovered, but it was not only a satisfaction but also a great pleasure to me to corroborate in my own experience what had been already discovered and so well described by Perroncito and Leichenstein. To the former is due the credit of laying the foundation of all our knowledge of this parasite, and although he made the mistake of supposing that the calcified encystment of the larva was the final stage of its life in the free state, instead of being what it really is—its death—yet this is a minor mistake, in view of the services he rendered to scientific research in this respect.

Leichenstein's investigations are a model of research, such as we are all so familiar with in recent times, and to him is due the final say in the matter. He is about to publish his researches in full shortly, but he has already given us a summary of his work, which I strongly recommend to those of you who may not have seen it, and who are interested in the subject. After the publication of Dr. Giles' Report of kala-azar in Assam, I again resumed my cultivation of the larvæ, in case it was possible a mistake had been made in the life history of the larvæ in the free state. As you are aware, Dr. Giles, in that report, says that the larvæ of the anchylostomum duodenale, after undergoing several ecdyses, become sexually mature in the free state and are capable of indefinite existence in this state: provided always the conditions as to nourishment are favourable. To determine this point I carried on cultivation for about six months after the publication of the Assam Report, and I could come to no other conclusion than that which I formerly arrived at, *viz.*, there is no true ecdysis in the life history of the larvæ, and its final stage in the free state is encystment, and unless the encysted larvæ finds access to the human intestine it perishes. If it does find access there it developes into the sexually mature parasitic form in the course of from three to five weeks, and ova begin to appear in the fæces. It is difficult to prove this latter in one's own individual experience, but it has apparently been done by Leichtenstein. Any one, however, can satisfy himself by simple cultivation of the ova that the last stage of larval life is encystment. The fæces should not, however, be cultivated either on sand or garden mould. It is extremely difficult to distinguish the larvæ of the anchylostoma from those of the free living nematodes which, after undergoing several true ecdyses, become sexually mature, and reproduce themselves indefinitely, provided they receive due supplies of nourishment. These, I need scarcely say, do not lead a parasitic life. Taken into the stomach, they either perish or pass through the intestines. The life history of the larvæ is a matter of some, if not of considerable, importance in the prophylaxis of the disease. If Dr. Giles is correct, mud must be the chief source of infection. The rhabdites do not live in water, mud is their habitat. They are capable of wandering in search of food over long distances, and it may be inferred that if the anchylostoma larvæ assume this form, they are also capable of leading the same life as the free living non-parasitic nematodes. It is true that infection does undoubtedly occur from the swallowing of mud, but if, as I maintain, it is a fact, that the anchylostoma larvæ become encysted, as the final stage of life in the free stage, their infection through mud is the exception, not the rule. Anyone engaged in the cultivation of the larvæ will very quickly satisfy himself that, whilst the presence of mud water in the fæces interferes with, if it does not altogether prevent, the development of the embryo into the encysted larvæ, the latter lives almost entirely in water, in which it continues to exist possibly over a twelvemonth. This was proved in the experience of Leichenstein. In my own experience I can say that in ordinary fæcal cultivations it undergoes calcification and degeneration at a much earlier period. The danger is therefore undoubtedly from the water supply.

Dr. Dobson has lately raised the question in India whether this parasite can at all be considered as the cause, or principal cause, of the disease known in

Assam as kala-azar, and, as from Dr. Giles' Report there can be no doubt kala-azar is identical with the "Anæmia of Ceylon," of the latter, the life history of the parasite itself is of great moment in determining this point. Is the worm capable of producing a profound cachexia such as we find present in extreme cases of these? As a matter of fact the parasite lives on the blood-plasma, rejecting the corpuscles, and is provided with a piercing and suction apparatus capable of taking its supply from the living stream of blood. It is true that the quantity taken up in this way in the 24 hours is extremely small, but still it is a loss—a loss it is true never felt by the system until it amounts to a quantity which the nourishment is not capable of replacing. The system then begins to feel it, and the greater this quantity becomes the more rapidly does the system deteriorate. It is, therefore, clear that the amount of damage done is in direct proportion to the number of parasites at one time present in the intestine. As the average duration of life of each parasite as a rule varies, within certain definite limits, say from one to three years, whilst it is incapable of reproducing itself within the intestine, it is evident that by fresh accretions from without a state of chronic cachexia might be kept up for years, if not for a lifetime, whilst on the other hand an acute form of anæmia might be produced by swallowing a large number of larvæ all at once in water,—impossible to do so in mud; and if no further accretions be made to the number, the patient would recover without help in course of time. I think it therefore but reasonable to suppose that under certain conditions the parasite is capable of doing harm—harm to account for the condition we find in "kala-azar" and "anæmia of Ceylon." I would, however, deprecate naming this state anchylostomiasis if thereby is to be understood a disease, an entity, such as small-pox, enteric fever, &c. It is not a disease in this sense. It is a cachexia, in the production of which several factors may be concerned. Malaria is undoubtedly one of these factors, and it is a matter of degree whether we have before us a case of malarial cachexia, dochmius cachexia, or dochmio-malarial cachexia.

Other factors, especially chronic dysentery, may also conduce to the cachexia, but in giving a name to the condition these need not be enumerated. I would further deprecate calling every case in which the ova are found in the fæces cases of anchylostomiasis. I think it would be better to drop this name altogether, as it is misleading. Dr. Dobson has done the further service of showing how widely the parasite is distributed in India, and how very little harm it does in a great number of instances. This is also my own experience in Ceylon, although I admit that under certain conditions it is capable of destroying life, and that in large numbers. The parasite was widely distributed in the plains of Lombardy long prior to the outbreak at St. Gotthardt, yet it was never looked on as destructive to health or life until that outbreak occurred. Here the conditions for rapid multiplication and infection were so extremely favourable that it made itself quickly felt, and I have no doubt the same causes are at work, on tea estates both in Assam and Ceylon, with results disastrous to the cooly. This state is easily met with a few precautionary measures on the estate itself. These measures resolve themselves into due care for the water-supply and the treatment of cases there and then on the spot; subjecting the coolies to any quarantine with a view to examination and treatment before allowing them to proceed to the tea districts would, in my opinion, not only be useless, but might interfere with the labour-supply. Treatment, such as Dr. Dobson submitted the coolies at Dhubri to, on their way to Assam, certainly would not prevent this parasite being imported, and any diminution in the number of parasites by the treatment would be of minor importance, considering the number of ova the female is capable of laying and the rapidity (from 7 to 14 days) with which encystment takes place, and infection occurs under favouring conditions. The true prophylaxis must begin on the estate. As I said before, the water-supply must be kept free from contamination, should be filtered, if possible, for drinking purposes, the simplest filter, such as a piece of calico, serving the purpose of freeing it from any encysted larvæ and latrines, which need not be elaborate to secure the fæcal matter from finding access to the water; this simple scheme would certainly not be costly, and would meet the difficulty to a large extent. It is, however, possible to carry out the scheme in a much more elaborate manner and with greater efficiency, but at a greater cost. Considering, however, that the cooly is constantly exposed to other noxious influences equally, if not more, destructive in their results than the anchylostomum duodenale, I scarcely think the improvement which would be produced in his state of health by the complete destruction of parasite would be such as to justify the great difference in the expense between the simpler and more elaborate scheme.

ON THE PREVALENCE OF THE ANCHYLOSTOMA DUODENALS IN MADRAS.

BY C. H. WILLIAMS, M.D.,
Surgeon-Captain, I. M. S.

Of the last fifty post-mortem examinations I have made in the General Hospital, Madras (that is since March last), in which the small intestine has been examined, this parasite has been found in twenty-six, or fifty-two per cent. The diseases of which the twenty-six hosts died were as follows:—

Diseases of the Abdomen—

Cirrhosis of the liver	4
Dysentery	3
Perforation of stomach	2
Cancer of stomach	1
Pancreatic abscess	1
Diarrhœa with ulcers in large intestine	1
Tubercular peritonitis	1
Suppurative nephritis	1
Cystitis and Pyelitis	1

DISEASES OF THE CHEST—	
Pneumonia lobular	2
Pyo-pneumo-thorax	1
Mitral Stenosis	1
DISEASES OF THE HEAD—	
Cerebral thrombosis	1
GENERAL DISEASES—	
Traumatic tetanus	2
Malarial fever	2
Starvation	1
Anchylostomiasis	1

Besides these twenty-six cases eight were returned as anchylostomiasis by the physicians in charge of the wards, one being the case included above; and of these six were discharged cured and one relieved.

As regards the nationality of the twenty-six hosts, twenty-three returned themselves as Hindus, one each as Eurasian, Native Christian and Pariah. Two of the Hindus were Nayars from the West Coast, the rest were the ordinary Tamil cooly class drawn chiefly from the neighbourhood of Madras, but partly from the whole Presidency, many coming long distances. The actual figures are five born and bred in Madras; nine who had been some weeks to a few years there; eleven who came from other parts of the Presidency direct to the hospital, and one, a beggar, who had probably been all over the districts. This shews that the parasite exists both in the Presidency Town and widely throughout the Presidency. The ages of these patients varied from 16 to 70, the average being 36. This hospital admits as in-patients only males over 12 years of age, and no statistics are therefore available for women and children.

Those cases are returned as anchytoslomiasis in which the eggs of the worm are found in the fæces in great abundance, and no other cause is evident for the very marked anæmia from which they suffer. Usually they give a history of an anæmia increasing for one or two years with, in some cases, but not in all, a febrile onset of a few days, and usually some discomfort, doubtless duodenal, referred to the epigastrium.

Of organic changes produced by this parasite, I have found none certain, but in two cases changes which I was inclined to attribute to them. One was in a case which died from perforation of the small intestine high up. The perforation had taken place through a cicatricial mass, not much indurated, encircling the bowel; and the duodenum and first few feet of the ilium were found to be the seat of eleven circular cicatrices, some as much as two inches long, and most unusual in appearance. I thought, and still think, these were due to the bites of anchylostomata at some previous time which had ulcerated and cicatrized. If not, I do not know to what they were due. The case is recorded in the Transactions of the Madras and South Indian Branch of the British Medical Association for this year, a plate accompanying it.

The man was not markedly anæmic at the time of death, but a few anchylostomata were present. No good history could be obtained, as he was moribund on admission.

The other supposed organic changes were a considerable cirrhosis of the pancreas, a certain amount of interstitial nephritis and a doubtful interstitial change in the lever in the post mortem on the case of anchylostomasis. This might possibly have been produced by long continued reflex-irritation, though I am far from asserting that it was.

As to the numbers in which these parasites are found, they are as a rule not many; but usually, where they are present, some bites are visible on the duodenal mucosa. Females as usual much predominate. The conclusion to be drawn from this is that, whereas the parasite is very commonly present amongst the poor natives who come to this hospital, any actual disease worthy the name of anchylostomiasis and produced by them is rare.

CLINICAL FEATURES OF BERI-BERI.

BY D. BASU,
Surgeon Major, I. M. S.

THE subject of this paper is a disease about which our knowledge is by no means very clear. It is the want of a clear and accurate knowledge of this disease that has prompted me to take up this subject.

From Chevers' Commentary, I learn that Dr. Malcolmson referred to a peculiar form of paralysis of the lower limbs due to peripheral neuritis, and to alteration in the lower part of the spinal cords. In most of his cases there was more or less paralysis; 57 out of 65 had numbness of feet and hand, 40 had pain and soreness, 40 œdema, 33 spasms, 11 had the gait of the sheep, 12 tottering in walking, and 2 a sense of weight in the limbs or thorax (I.M.G., January 1882.)

Morehead says that it (beri-beri) is a general dropsy of a complicated character. That the blood is sufficient in quantity, but there is water in undue proportion. It is present in the scorbutic diathesis.

As to the cause, he says: "So watery blood and feeble heart predispose and exposure to cold and damp become the exciting cause."

The disease he calls beri-beri presents the following symptoms, which may come on suddenly or gradually: weakness, unwillingness for exertion, oppression and weight at the epigastrium, dyspnœa, palpitation, quick small pulse, becoming intermittent and fluttering, scanty high-colored urine, vomiting, anasarca and bloated appearance; serous effusion into the areolar tissue of skin, and into the pleura, pericardium, and peritoneum, pain, numbness, stiffness, with œdema of lower extremities, which subsequently become paralyzed. Among morbid appearances he mentions anasarca, œdema of lungs, hydrothorax, hydropericardium, ascites, cranial effusion. In some cases traces of old or recent inflammation of viscera.

Professor McLean defines beri-beri as an extremely fatal disease, characterised by anæmia in an extreme degree, ascending motor paralysis, chiefly of the lower extremities, scanty high-colored urine, general œdema with effusion into serous cavities, chiefly the pleura and the pericardium; occasionally acute pain and oppression at the epigastrium. Death occurs generally suddenly either from dropsical effusions into the thoracic cavities, failing at the heart, or embolism. As to causes, he lays stress on climatic conditions unfavourable to health, all of which bring about anæmia or scurvy. As to its relations to scurvy, he says: "I am strongly of opinion that scurvy plays a much more important part as a predisposing cause than is generally accepted." He divides the cases into acute and chronic. In some of the acute cases he says the whole duration of the case does not exceed 24 hours, while there is intense anæmia, paralysis, generally œdema and effusion of fluid into the cavities. He distinguishes the two types of the disease, and says sometimes the paralytic symptoms are marked, in others dyspnœa and dropsical symptoms are more urgent. In all there is evidence of intense anæmia, anasarca, prostration, quick small pulse with subnormal temperature and scanty urine. As to morbid anatomy, he refers to the watery condition of the blood with diminution in the number of red blood globules, and presence of water in every organ or tissue of the body; the heart is enlarged, soft and flabby; the spinal cord is almost always congested, and fluid is found in the spinal cavity.

Sir W. Moore considers beri-beri to be a peculiar form of scurvy. The symptoms of the disease, according to him, are great debility, stiffness of legs and thighs, succeeded by numbness and swelling of those parts, with great difficulty in using the limbs. Then the body becomes swollen, the breathing quick, and the pulse feeble, while the urine is scanty and thirst great. Diarrhœa and insensibility terminate the illness.

Sir J. Fayrer defines the disease as follows:—

"A disease characterized by anæmia, anasarca, degeneration of muscular tissue, effusion into the serous cavities, debility, numbness, pain, and paralysis of the extremities, specially the lower, pericardial anxiety, pain, and dyspnœa, scanty, high colored urine; and in some cases drowsiness and sleepiness." Among causes, he mentions certain conditions of soil, air, and water, food deficient in quantity, quality or variety. Death results rapidly in some acute cases, with symptoms of effusion into thoracic and abdominal cavities, or within the skull; by exhaustion, syncope, or formation of coagula either in systemic or pulmonary circulation. Sir Joseph suggests that the symptoms might be due to the presence of some kind of hæmatozoon in the blood.

I now beg to place before you, gentlemen, the views held by different observers on some epidemic outbreaks of disease which have been called the "beri-beri," "acute epidemic dropsy," "beri-beri fever," and "acute anæmic dropsy." The first of these outbreaks took place in the criminal prison at Singapur in the year 1875, and continued till 1880. Dr. J. Rowell, Principal Medical Officer, Straits Settlements, noticed that the symptoms set in either gradually or suddenly, and that they were weakness, lassitude, inaptitude for exertion, general anasarca, sense of fullness at the pit of the stomach, tension and weight at the pericardia, dyspnœa, vomiting, uneasy sleep, feeble, frequent pulse, fluttering of the heart, muscular spasms, stiffness of the legs and thighs, followed by numbness, later on by œdema, and sometimes paraplegia; with a scarlet aspect the extremities were cold. The bowels were torpid and urine scanty, high-colored, albuminous. The intellect remained unclouded, the gums were spongy. Burning of hands and feet was not observed as a symptom, nor any fever. Mortality ranged between sixteen and twenty per cent. Death sometimes took place suddenly within a few hours.

Soon after this outbreak in Singapur, an epidemic disease invaded Calcutta and its neighbourhood in 1877. It was at first styled the "new disease," and then different observers applied different epithets to it. Some called it "beri-beri," others "acute œdema," others again "epidemic dropsy," and a few took it to be an exanthematous fever. A similar disease also appeared soon in Dacca, Shillong, and Sylhet. Most of the popular practitioners at Calcutta, Native and European, witnessed the epidemic, and had to treat cases of the disease. The members of the Calcutta Medical Society took a great interest in the disease, and interesting descriptions took place at their meetings as to the nature of this new disease. There was a great difference in the opinion of different observers.

Dr. Smith said that scorbutic dyscrasia, which is so prominent a feature in beri-beri, was markedly absent in this disease. Even latent scurvy seemed to be absent in many cases. Nervous pain and sensation of burning were commonly experienced, and discoloration of the skin was noticed.

Dr. Harvey considered the disease to be beri-beri. He found distinct anæmia in all, and anæmic bruit in several. Anæmia was a constant condition which he found. Many suffered from fever. There was enlarged spleen in many, but not in all cases. A few had scorbutic or at least spongy gums. In two cases he found an approach to paralysis of the lower limbs, as if from effusion of serum into the spinal canal, and in a good many more there was great difficulty in walking, apparently not due to paralysis, but to the local condition of the limbs.

Dr. McConnell reported that the disease was not at all special or peculiar; that its essence was intermittent fever, with great anæmic exhaustion; œdema of the feet, or in some cases the upper limbs, or even general dropsy, occurring in persons reduced to low health. Dr. Rammoy Roy, then in charge of Sambhoo Nath Pandit's Dispensary, Bhowanipur, having returned from Madras, where he had seen 500 cases of beri-beri, had to treat 150 cases of the new disease. He had no difficulty in identifying the disease as beri-beri, which he had treated in Madras.

Dr. Coates had seen beri-beri among the Madras sepoys at Cuttack, and also cases of the new disease, or acute œdema in Calcutta; and he was of opinion that the disease that he saw in Calcutta was not the same as what he had seen among the sepoys in Cuttack, *viz.*, beri-beri.

Dr. O'Brien's experience of about 200 cases in Shillong led him to form the opinion that the disease was as contagious as measles, scarlatina, and other infectious exanthemata. He did not find scorbutic diathesis in a large number of cases. In several cases there was no appreciable fever. He had met with œdema of the lungs, and pneumonia in some cases, and had met with several deaths.

Dr. K. McLeod, who had ample opportunities to elicit information on the subject of the new disease at the time, has given his views on the subject in the elaborate paper on "Epidemic Dropsy," read by him before the Epidemiological Society of London. He says: "I incline to the belief that the disease was really an exanthematous fever, the dropsy constituting a phenomenon homologous to eruptions of such diseases." Again: "Nor do the nature and course of the disease warrant any suspicion that it was due to any intestinal parasite, similar to that which has been found in Ceylon and Assam, to be associated with the prevalence of anæmia and cachectic states, frequently terminating in dropsical effusion."

Among the symptoms of the disease he mentions: Dropsical swelling of the limbs, occasionally of the body and face. Fever sometimes before, sometimes after, the swelling, in some cases absent; diarrhœa commonly, dysentery in a few; burning and pain in the affected limbs at commencement. Purple livid discoloration of the skin in some cases, disappearing on pressure; urine scanty or excessive without albumen. Dyspnœa cough and palpitation in most cases, great emaciation, prostration and anæmia. Death often sudden and early. Of the several symptoms dropsy constitutes the most prominent and apparently the essential and indispensable feature of the disease; the other symptoms might or might not be present. Pyrexia, a frequent if not a constant symptom, skin irritation and deep-seated pain in the limbs is a decided feature of the disease. Paralysis was absent. An exanthematous eruption was a feature of the disease in a certain proportion of the Calcutta cases. Disturbances of respiration and circulation were quite prominent phenomena. Anæmia was an essential feature of the disease, but evidences of scorbutic dyscrasia were less marked.

After reviewing the reports on the outbreaks of "beri-beri fever" in different parts of the country, Dr. N. Chevers formed the opinion that the disease belonged to the class of exanthemata, and that the dropsy and the paralytic symptoms were only the sequelæ of the disease. And further he says: "Although its manifestations are numerous and complex, I think that on carefully studying its phenomena we cannot fail to arrive at the conclusion that the acute epidemic beri-beri is not, as some have thought, a group of diseases, but a malady quite distinct from all others, a fever of varying type, but characterized by a very marked individuality." Regarding its relation to scurvy, he says: "I think that, when we state the fact that, wherever beri-beri prevails, it specially selects the scurvied, we are free from the error of supposing that acute beri-beri is an expression of scorbutic cachexia"; and regarding its connection with malaria, he says: "I think we are justified in concluding that beri-beri is not a malarial fever, but that the victims of malarial cachexia are specially liable to suffer from its effects." Viewing beri-beri in its paraplegic aspect, Dr. Chevers says: "One of the leading sequelæ of beri-beri being anasarcous and dropsical effusion into the areolar tissue and serous cavities, the occurrence of spinal paralysis in various degrees as one of its complications is clearly accounted for." Then he says: "The stiffness of the lower limbs is frequently due to the presence of hard œdema, not to spinal paralysis, ; but in many cases of beri-beri distinct impairment of motor and sensory power in the lower limbs had been observed."

We may observe how very difficult it was to come to a definite opinion as to the nature of the disease, and how very different were the views held by the different observers. Even Drs. Harvey, Coates, and Rammoy Roy, who had seen true cases of beri-beri in Madras and elsewhere, differed in their opinions; while Drs. Harvey and Roy thought the disease to be beri-beri, Dr. Coates did not. Dr. Smith also was inclined to think that it was not beri-beri. Dr. McConnell thought it was essentially intermittent fever neglected, aggravated and complicated. Both Dr. McLeod and Dr. Chevers held that the disease belonged to the class of exanthemata, and yet their views were different. While one takes it to be true epidemic beri-beri and calls it by the name "beri-beri fever," and lays particular stress on the fever and eruption on the skin, and considers the dropsy and the paralytic symptoms to be sequelæ of the disease, and considers the malarial and scorbutic dyscrasiæ to be favorable circumstances, and does not say anything about anæmia, the other thinks the disease to be different from beri-beri and calls it "epidemic dropsy," and says that the dropsy constitutes the essential and indispensable feature of the disease, the other symptoms might or might not be present. Next to dropsy, he considers anæmia to be an essential feature of the disease, and further that fever was frequently present, if not constantly. An exanthematous eruption was a feature of the disease in a certain proportion of the cases only, and that the symptoms were not likely to be due to any intestinal parasite.

This brings us to the outbreak of an epidemic disease called by the name of "acute anæmia dropsy," which took place in the Island of Mauritius in 1878-79. From Dr. Lovell, the Chief Medical Officer's report, we gather that the most prominent symptoms of the disease were anasarca of the lower extremities often extending to the upper extremities and trunk and seldom to the face, and in worst cases complicated with ascites, hydropericardium, hydrothorax. The premonitory symptoms were diarrhœa or vomiting or both, deep-seated pain in the limb, epigastrium, and abdomen, accompanied with slight fever and in most cases by a roseolar rash. Dr. Lovell said that the anasarca was one of the most striking features of the disease, and anæmia was a constant feature. He distinguishes "acute anæmia dropsy" from beri-beri. The first distinction is the absence of paralytic symptoms; second, the low mortality (2 or 3 per cent.); third, the presence of the preliminary symptoms of diarrhœa or vomiting, which were absent in beri-beri; and fourth, the presence of the rash which is not met with in beri-beri. His conclusion is that the acute anæmia dropsy is a disease *sui generis*, not due to malaria, nor identical with beri-beri.

Beri-beri prevailed very severely in 1885 and 1886 in Sumatra and Java and caused very heavy mortality, which led the Netherland's Government to depute Professor Pekelharing to investigate the cause of the disease, and to suggest preventive measures. Here the disease was characterised by the peculiar paralytic symptoms in addition to the anæmia. *Post-mortem* examination of bodies showed that the symptoms were due to degeneration of nervous tissues, particularly the peripheral nerves. Professor Pekelharing discovered a peculiar kind of micro-organism in the blood of patients. Dr. Max Glogner, of the Dutch Archipelago, noticed a constant weariness and painfulness of the lower extremities, and abnormal condition of the heart, shortness of breath. He found that not only the coloring matter of the blood, but also the number of red blood cells, was diminished. He admits that in the course of the disease a pernicious influence on the blood is visible, and he compares beri-beri with malarial fever, and points out certain resemblances between them, including the efficacy of quinine in beri-beri.

Beri-beri is endemic in Ceylon. Here it was that Dr. Kynsey found the anchytosloma duodenale in the intestines of the patients suffering from beri-beri. He attributed the anæmia and the dropsy to the presence of these worms in the intestines, and did not recognize any other disease as beri-beri apart from anchylostomiasis.

Surgeon-Captain Evans considers beri-beri to be due to malaria. He had seen the disease as it prevails in Burma. There the prisoners in the Mandalay Jail suffered from the paralytic form of the disease. He has also seen the disease in Assam, where it assumes the progressive pernicious anæmic type, accompanied by dropsy. From careful miscroscopical examination of blood in each case, he comes to the conclusion that both the forms of the disease have a common origin in the blood poisoning produced by malaria. (I. M. G., December 1892).

Dr. Thomas, Medical Officer, 17th M. I., in his paper on the subject of beri-beri, gives his views regarding it, after having treated a large number of cases. He says: "In a very large number of my cases the proximate cause was due to the presence of anchylostoma duodenale in the intestinal canal: the greater the number of these parasites present, the greater the severity of the disease."

Among the symptoms of the disease noticed by him are: weakness and stiffness of the ankles, legs, thighs, numbness followed by burning in the sole of the foot; œdema, puffiness, swelling and lividity of the face; unsteady, tottering gait; great prostration; scorbutic taint in 41 per cent. of the cases; pain in the ensiform cartilage; loss of sensation in the feet and legs; cutaneous anæsthesia; loss of irritability to mechanical and electric stimuli; tenderness of the gastrocnemii muscles; absence of patellar tendon reflex; spasm of the limbs; dyspnœa hurried; irregular and painful respiration; serious effusion into the cavities; general anæmia; pericordial anxiety; irregularity and palpitation of the heart; great nervous depression; peri-and endo-cardial effusion with failure of the heart; scanty high-colored urine.

This is also the view which Surgeon-Major Giles holds as to the nature of beri-beri and kala-azar, diseases which have prevailed so severely in the province of Assam within the last few years. Deputy Surgeon General Costello, Principal Medical Officer and Sanitary Commissioner for Assam, in his Annual Report for 1888, makes special mention of these two diseases. He first describes the peculiarly unhealthy and insanitary conditions in which the people live—conditions which are most favourable to the production of malarial fever, and then gives his opinion that he could in no instance distinguish any cases as being in the least different from a very aggravated form of malarial fever, with its usual results when so aggravated and neglected. Further on he says that "the opinion of the best Civil Surgeons of the province, as well as my predecessor, an officer of great experience, was, and is, that the apparently peculiar form of fever is nothing more than a very aggravated and often neglected malarial fever and that its so-called distinguishing features, such as anæmia, enlargement of the spleen and liver, with dropsy, diarrhœa, &c., &c., are ordinary results of unusually severe and neglected malarial fever." He also recommended to Government that an officer should be specially deputed to investigate into the causes of the heavy mortality from these two diseases.

Thereupon, Surgeon-Major Giles was specially deputed to Assam. Dr. Giles submitted his report in 1890, I believe, but I regret I have not got a copy of his report, and I shall therefore refer to the *résumé* of the report as it appeared in the *Indian Medical Gazette* (June-July 1892). Surgeon-Major Giles did not find any such disease as the epidemic peripheral neuritis of Malcomson in Assam, and after comparing the cases, he came to the conclusion that kala-azar and beri-beri were identical and not two different diseases. Then he says: "The disease is characterized by extreme anæmia, a peculiar leaden tone of the complexion, while the conjunctiva presents a peculiar bluish-white tint, dyspepsia, occasional attacks of pyrexia, diarrhœa, distressing breathlessness, and finally dropsies of the serous cavities and of the lungs, and cellular tissue. The patient is reduced to a helpless condition. Profound depression of the system, persistently subnormal temperature. The immediate cause of death is commonly either dysentery, pneumonia or bronchitis. The stools of patients contain many anchylostomata; and *post-mortem* examinations of bodies showed that the intestines harboured these nematode worms in numbers, where they acted as so many blood-suckers." From all these, Surgeon-Major Giles came to the conclusion that the anæmic and other symptoms of the disease were attributable to the presence of this worm in the intestines, and gave the name of "anchylostomiasis" to the diseases known as beri-beri and kalaazar in Assam.

Dr. Dobson, late Civil Surgeon of Dhubri, who enjoyed very favourable opportunities of studying the diseases, and who made very careful and searching enquiries into the prevalence of anchylostomiasis in India, is worth referring to in connection with these diseases. Dr. Dobson's experiments on the emigrants passing through Dhubri to Assam prove the almost universal existence of the anchylostoma in Bengal, Madras and Nepaul, when 65·38 per cent. of the healthiest looking of the imported population of Assam is found to be affected with the parasite while in transit from the recruiting districts to the labour districts. In one place Dr. Dobson says: "In my enquiries I have noticed numbers of cases where the parasite was found, but where anæmia was wanting altogether, or not present at first. Again, all the healthy coolies and prisoners, &c., showed not a trace of anæmia, although in a large proportion in them the anchylostoma existed in numbers. In others in bad health, the anæmia has been intense and the parasite found; and in several dropsy and anæmia were found, but no parasites. These anæmia cases from the first were looked on as cases of beri-beri." In another place Dr. Dobson says: "I contend that malaria has a great deal more to say to this excessive mortality in this district (Goalpara) under the heading kala-azar than Surgeon-Major Giles gives it credit for; and further we have still to learn more regarding the pernicious effects produced by anchylostomiasis before we can credit them with the disease known as kala-azar, and which latter, I take it, is malarial poisoning."

Dr. Dobson makes a distinction between the kala-azar and the beri-beri cases. In the former cases emaciation is a leading symptom, but anæmia is not generally present. The spleen is much enlarged. Generally there is no dropsy, and there is a history of fever. The beri-beri cases have intense anæmia, at times coupled with dropsy, which may be general or partial, but no enlargement of spleen.

Dr. Sandwith of Cairo has written an excellent paper on anchylostomiasis. He says the digestive system is first affected and the symptoms begin with pain in the epigastrium, the appetite is affected, sometimes there is an earth-hunger, constipation is a constant symptom, the urine is pale in color and of low specific gravity, with a trace of albumen in most advanced cases, pain in the head, giddiness, pain and weakness in the knees; there is palpitation, hypertrophy of the heart in some advanced cases, dyspnœa and noises in the ears, marked anæmia, pallor, œdema of the legs, diminution in the number of red blood cells and amount of hæmoglobin, sub-normal temperature and debility and wasting. Dr. Sandwith is of opinion that the disease is due to the presence of anchylostoma in the intestines. He does not consider his cases to be cases of beri-beri, which he says would seem to be a specific peripheral neuritis.

From the above brief survey of the views held by the different authorities in regard to beri-beri, we gather that the term has been applied to different or at least dissimilar diseased conditions of the body, that by one set of observers the disease is considered to be an outcome of scurvy, or a peculiar manifestation of that pretty well recognised disease. Among them we find the names of Morehead, Maclean, and Sir W. Moore.

Then we find at least two if not three observers who take beri-beri to be a peculiar exanthematous disease, infectious and having its period of incubation and development and abatement, and its sequelæ. One of them, Dr. Chevers, takes the disease to be a form of fever and calls it beri-beri fever. The other (Dr. McLeod) takes it to be essentially a kind of dropsy. Dr. O'Brien also thought the disease to be exanthematous in nature.

Dr. Rowell of Singapur calls the disease that broke out there to be beri-beri. Dr. Lovell of Mauritius takes his cases to be a peculiar form of dropsy due to anæmia.

Then again, we find some who consider beri-beri to be a peculiar manifestation of malarial cachexia, or at least analogous to malaria, and due to similar causes or originating under similar circumstances. Among them we find the names of Dr. Max Glogner and Dr. Evans. We may also mention the name of Dr. Costello as holding the same view, though it is not beri-beri exactly he refers to, but kala-azar which he takes to be the result of malaria. Dr. Dobson also thinks kala-azar to be mainly, if not solely, due to malaria; and even beri-beri is probably not due to what is called by another set of observers to be anchylostomiasis. Among them we find the names of Dr. Kynsey, Dr. Thomas and Dr. Giles, and lastly, while Dr. Giles is of opinion that the kala-azar and the beri-beri of Assam are the one and the same disease and due to the presence of anchylotoma duodenale in the intestines, Dr. Sandwith of Cairo, while admitting that the pernicious anæmia of the tropics is due to the nematode worm, does not think it to be identical with beri-beri, but takes beri-beri to be a kind of epidemic multiple or peripheral neuritis as described by Dr. Malcolmson fifty years ago, and as has been lately observed by Peckelharing and Winkler in Sumatra and Java. Again, Dr. Dobson, while admitting that a peculiar form of anæmia (now malarial) might be due to the presence of næmatode worm, opposes Dr. Giles' theory that the kala-azar and beri-beri of Assam are due merely to the presence of the worm in the intestines, as he has found the healthiest men of different parts of the country to harbour such worm without in the least suffering any evil effects from the same.

DISCUSSION.

R. L. Dutt (Hooghly) in his experience had found the moist variety of the beri-beri to be most commonly prevalent in Bengal, especially in Assam and the adjoining districts. The most common symptoms were those of peripheral neuritis, commencing in the legs, but the characteristic groups of symptoms consisted of cardiac weakness and subsequent dropsy, both subcutaneous and visceral, all due to degeneration of the cardiac fibres of the vagus. The first symptoms observed were increase of cardiac dulness to the right with rough first and accentuated second pulmonary sounds, with occasionally full veins in the right side of the neck. These symptoms coincided with complaints of weakness and paræsthesia of the legs.

The so-called Assam fever he found on analysis to consist of three groups of cases :—

1. Malarious fever
2. Moist beri-beri
3. Anchylostomiasis

One or two or all the causes may exist in a single case. The most common combination is chronic malarious poisoining with beri-beri. The dry variety of beri-beri was rarely seen in Bengalis. It was frequently observed in Chinamen in Calcutta. The principal symptoms were paræsthesia and hyperæsthesia with diminished knee jerk, without any perceptible muscle atrophy with paralysis of the legs supervening. The cardiac and dropsical symptoms were absent in the cases he had seen, and it followed a very chronic course.

R. W. Pilgrim (Calcutta) wished to add a few remarks on the subject of beri-beri based on an experience of upwards of 200 cases which had come under his observation during the last three years. They had occurred in every case in one section of the community alone, *viz.*, the Chinese, and almost invariably amongst those who were carpenters, the bootmakers enjoying an almost complete immunity from the disease. The cases were at first regarded as peripheral neuritis, due probably to exposure, syphilis or other causes, but as the cases became more numerous, and were investigated more closely, it was found that the circulatory system was almost always implicated in a most characteristic manner. It was found that about 50 per cent. had well marked mitral regurgitant murmurs, which usually disappeared under rest, removal from the focus of infection, and tonic treatment. In the remaining 50 per cent., though there was no murmur the first sound was often impure, the second pulmonary sound accentuated, and in a few cases hypertrophy, and in one dilatation of the heart was noticed ; but one of the most characteristic features of circulatory disturbance was that recently noted by Dr. Glogner in an interesting brochure, *viz.*, the remarkable variation in the frequency of the heart beat ; in the morning, for instance, the frequency would be, say, 60, the same evening 90, next morning 70, and perhaps 50 the same evening. Dr. Pilgrim regarded this as most charateristic of the form of disease he was describing. Another point he noticed was the peculiar absence of anæmia in the great majority of these cases ; in only very few was even a moderate degree of anæmia present, and the presence or absence of anæmia was carefully determined by the use of the hœmocytometer. Another sign that was present in a large number of cases was a fine tremor of the hands. The clinical history of most of these cases was briefly as follows : A healthy man would be attacked with fever lasting a few days, associated with, or shortly followed by, œdema of the feet and legs (this was not always present), and pains in the calves of the legs and burning sensation over the epigastrium. These symptoms were usually associated with palpitation of the heart and even actual dyspnœa in certain cases. As a rule when the acute symptoms of invasion were passing off, and the patient began to get up, he found his legs, and in many cases his hands or wrists, were extremely weak, and this weakness increased from day to day, till the characteristic reeling gait with wide intervals between the feet was established, and in bad cases until the patient was absolutely unable to get up and stand. In all cases the patellar reflex was either abolished or at least markedly diminished, though in some cases during the early days it was augmented. Associated with this paresis was marked impairment of the sensibility of the skin to touch—a frequent but not constant feature of the disease. In only one case was there general anasarca, and only three of the cases died. With regard to etiology, the stools of a large number of the cases were diligently searched by himself, and especially by Dr. Walsh, to discover if there were signs of the presence of anchylostomata, but to no purpose. In a lesser number of cases the blood was stained and examined under a high power, but they were unable to find any of the microbes so well figured and described in Pekelharing's Monograph, but this was probably due to the cases examined not being sufficiently recent or to their own fault, for in conclusion Dr. Pilgrim wished to say that, though Pekelharing's observations require confirmation, inasmuch as his inoculation experiments failed in a large number of cases, and because his series of cultivations are not altogether satisfactory, still he was convinced that future research would in great measure confirm those results, and at all events show that the disease was due to micro-organisms in the blood leading to lesions in the nerves.

A. H. Nott (Hazaribagh) had had of late somewhat unusual opportunities of *post mortems*, and thought his experience was perhaps worth mentioning. During the last two years he had seen nearly 70 *post mortems* on prisoners and had examined the intestines most particularly for anchylostomata. In only three cases were they found at all, and of these in one only were they in more than insignificant numbers, and in that case there could be no suspicion that death was due to their presence or was contributed to by them. These deaths occurred among prisoners not from one district but from nearly all districts in the province of Bengal.

A. Powell (Cachar) would advise the Congress to withhold its verdict on anchylostomiasis for further evidence, as the two chief and conflicting authorities in Assam were Giles and Dobson. The latter was of opinion that the worm is as common in the healthy as in those suffering from kala-azar. Giles in his *post mortem* observations, the *ultima ratio* of diagnosis, over 30 in number, found the worm in only three or four. In the majority of cases he found enlargement of spleen and liver, with congestion and small hæmorrhages in the pylorus and duodenum. Where he did not find the worms he made the very naïve remark that these small hæmorrhages were the bites of the worms, which had been expelled weeks or months previously. He could hardly believe he was serious. In the remittent fever of Assam the most constant *post mortem* signs Dr. Powell had found to be congestion, infarcts, hæmorrhages, thickening or hypertrophy of the organs supplied by the cœliac axis, that is to say, the spleen, liver, and duodenum with the neighbouring part of the stomach. Nearly all Giles' cases read to him as typical remittent malaria.

The President said that, while listening to the papers which had been read and the discussions on anchylostomiasis, kala-azar and beri-beri, he had been struck with the absence of any clear definition of the terms employed, and of any clinical definition by which the cases designated kala-azar, malarial anæmia and beri-beri were distinguished from one another. It seemed to him that the confusion surrounding the subject was the result of this want of definition. He ventured to make the following suggestion in the attempt to clear up the confusion, namely, that many cases described under the name of beri-beri did not appear to have any distinctive features entitling them to the name. He could not discover anything by which they were to be distinguished from ordinary malarial anæmia. Was it not probable that kala-azar is only ordinary malarial anæmia plus anchylostomiasis, and therefore not a specific affection ?

Such a supposition would seem to reconcile the opposing views. Beri-beri, on the other hand, was a specific disease marked by certain well-defined nervous symptoms, of which those resembling peripheral neuritis are the most common and characteristic. Only one or two of the cases referred to by Dr. Basu as occurring in the Mymensingh Jail presented any such symptoms. Without these symptoms no cases have any right to be included under the name of beri-beri. It would be the first step towards an elucidation of the relationship of these conditions to one another, if in future these distinctions were kept more closely in mind and the grounds for the differential diagnosis more distinctly ascertained and stated.

THE INDIAN SYSTEMS OF MEDICINE AND THE LESSONS THAT MAY BE LEARNED FROM THEM.

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When it was first suggested to me by the President of the Congress that I should write a paper on the Indian Systems of Medicine, I replied that I thought it would be better to entrust the subject to some one who had a wide acquaintance with original works in the ancient and modern languages of India, but it soon occurred to me that sufficient information on the subject was already available in English to render it almost hopeless to expect that anything new or of much value could be acquired in the short time at the disposal of members for writing papers. Moreover, I thought that a study of the ancient systems would be of most interest if confined to an attempt to discover whether they had succeeded or failed, and how much they had affected the present practice of medicine in this country, as well as how far they still prevent the general acceptance of modern Western medical science. It was my belief that many lessons might be learned from this enquiry, some of which at least might be of use, even to physicians and surgeons who practise after the most approved modern methods. The consideration of the subject involves, not only a rapid survey of the ancient practice of the Medical Art in India among the most educated Hindus, Mohamedans, and Parsees as well as, perhaps, among the peasantry, but also of the treatment which the people still receive. There remain also for consideration the reactions of the different systems upon each other, the effects upon them all of religion and superstition, and, lastly, the results of contact with European science, and with what for a time may prove even more powerful, European quackery. I shall also have to ask whether European physicians can do more than at present to increase the knowledge of their art among the people of India and to remove any prejudice against it which may exist.

The subject is so vast that in the very limited time allowed me I can only take a very superficial view of it. The history of medicine among the Hindus and Musulmans has been treated at more or less length by numerous authorities. A list of the principal of them up to the year 1876 will be found in a small book entitled "The Vydlan and the Hakim" by the late Surgeon-General Edward Balfour. As regards the Brahminical Hindus, the best summary is that of Weber, the English translation of whose lectures, dated July 1878, is the latest to which I have access.

Later authorities doubtless exist, but it is hardly necessary to refer to them for my purpose. Weber states that we find, especially in the Sanhita of the Atharvan, a number of songs addressed to illnesses and healing herbs, from which, however, there is not much to be gathered. Animal anatomy was thoroughly understood as each separate part had its own distinctive name, and Alexander's companions extolled the Indian physicians, especially for their treatment of snake bite.

The Indians consider medicine as an Upaveda, which they expressly entitle Ayur Veda. This is known only from extracts in the commentators, of whom Charaka, who may be spoken of as a physician, and Susruta, a surgeon, were the earliest and principal. The works of these writers existed before the 8th century, A.D., as, according to Ibn Beithar and Albiruni, they were translated into Arabic at that period.

Weber goes on to quote references which presuppose an advanced cultivation of medical science, but there is nothing very definite as regards the early period. He observes, however, that the number of medical works and authors is extraordinarily large. The former are either systems embracing the whole domain of the science, or highly special investigations of single topics, or, lastly, vast compilations prepared in modern times under the patronage of kings and princes. The sum of knowledge embodied in their contents appears to be most respectable. Many of the statements on dietetics and on the origin and diagnosis of diseases bespeak a very keen observation. In surgery, too, the Indians seem to have attained a special proficiency, from whom he thinks Europeans might learn something, as they have done in the case of rhinoplasty.

He thinks that "the branch of Materia Medica appears to have been handled with great *predilection*,* and concludes that during the last few centuries medical science has suffered great detriment from the increasing prevalence of the notion, in itself a very ancient one, that diseases are but the result of transgressions and sins committed, and from the consequent very general substitution of fastings, alms, and gifts to the Brahmans, for real remedies." He refers to the excellent commentary on Hindu medicine by Dr. Wise, and in conclusion holds that European physicians must have much esteemed the Indians down to the Seventh Century, as Arabian medicine constituted their chief authority, and was itself much indebted to the Hindus.

In a note on Weber's work Haas is represented as being quite opposed to the high antiquity of Indian medicine, as he traces even the most ancient texts to Arabian sources. The subject is extremely interesting, and our Indian members may add much to our knowledge of it by translating the best works.

Dr. Balfour refers to the statements of Charaka and Susruta and the early commentators that, without a knowledge of books, coupled with practical dissection, no one can be a proper practitioner, and remarks that "these sound views afford the explanation why the ancient system of Hindu medicine was so complete, and has been so permanent in its character."

Everyone knows that the Hindus, from a very early period, have given up the dissection of bodies, merely because it may occasion ceremonial uncleanness. Such prejudices did not exist in former times, and even Manu lays down that mere bathing will purify one who has touched a corpse, while stroking a cow or looking at the sun, having duly sprinkled the earth with water, will remove the defilement due to touching a dead bone.

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* This partiality for drugs is still very characteristic of the people of India.

In the present day so great is the terror of dead bodies that I have found it necessary to put up a notice in the Jeypore Museum on a case containing an Egyptian mummy to the effect that any visitor who has objections of the kind should avoid touching even the glass framework, otherwise he might feel it necessary to undergo a long ceremonial washing. Some Hindus go so far as to think a mere look defiles. The Hindus believed in the doctrine of Humoural Pathology, and considered that diseases were due to aberrations in varying degrees of the three humours, air, bile and phlegm (bat, pit and kaf). They endeavoured to restore the balance by careful dieting or elimination of the corrupted humours by means of emetics, purgatives, and blood-letting. There was a further division into sthenic and asthenic diseases which needed cooling remedies or the reverse.

The Yunani or Greek system, which is practised by Mohamedan *hakims* or physicians, is the second important division of medical practice in India. The chief light of this faith is Avicenna (Abu-ali-Sinaia), who borrowed largely from Galen. His great work on the principles of medicine, the Kitáb-ul-Qánun-fi't Tibb, is still a standard book in all countries in which Arabic is known.

This system is mainly that of Galen. Disease was due, he considered, to disproportion in the four states of the constituent elements, namely, the hot, the cold, the moist, and the dry, or to some unnatural condition of the organs.

He believed in the putrefaction of the humours which required elimination of the offending matter.

The Arabs borrowed from the Greeks and perhaps from the Hindus, hence the great point of similarity between the different schools, but the practices of excessive purging and blood-letting are more characteristic of the Yunani than of the Vaidic system, though both believe in starving out a disease. Like the Hindus, the Arabs did not practise dissection.

From the 7th to the 13th centuries the science of anatomy was stagnant. Indeed for 1,500 years, from about B. C. 300 or B. C. 200 to the year 1315, when Mondini dissected two bodies, there was no advance in any part of the world in the knowledge of the construction of the human frame.

Both *baids* and *hakims* share the prejudice, so long common in Europe, against surgery, which they have left to *jarrals* or rude uneducated surgeons, to barbers, quacks, and old women of both sexes.

In Europe the Church was responsible for the neglect of surgery, as the clergy were prohibited from the practice, because it caused the effusion of blood. This indifference was the natural offshoot of the neglect of anatomical study, because men, of course, feared to perform surgical operations which might involve immediate loss of life. It is true the Hindu works named 108 Marmasthanas or vital spots, but this was of no real assistance to the surgeon. The consequences of this neglect of one of the great divisions of the healing art were terrible to contemplate. The amount of torture inflicted in the rude attempts to reduce dislocations, to set fractures, and stop bleeding, to say nothing of the mischievous use of salves and irritants to wounds of all kinds, was appalling. Anyone who has practised a year or two in India can give numerous examples of such malpraxis. During the past year or two I have seen an attempt to drag out the upper fragment of the femur in a case of compound fracture, because it was mistaken for a piece of wood, which, it was supposed, had entered the limb, and I also know that several lives have been lost from tight bandaging in fracture, and within my experience in a remote part of India the stumps of amputated limbs have been thrust into boiling oil to check hæmorrhage. This was the practice in Europe before the time of Ambrose Paré, who first used, or revived the use of, the ligature to stop bleeding from the arteries.

There have been many specialists for particular surgical cases, as, for example, Sathyas, who practised reclination for cataract entirely after the old Greek method—men whose only occupation is to restore noses from the forehead, notably at Kot Kangra ; lithotomists, such as a man whom I once met in Marwar, who removed calculi with a rude hook and a scalpel by cutting through the rectum towards his finger with which he forced the stone forward; or another individual, a retired sowar, an operator in midwifery cases, who on one occasion amputated the arm in a shoulder representation and then fled. Then, again, there are knowing men with cattle, or blacksmiths who attempt the reduction of dislocations on human beings as they do with oxen and dealers in weapons and armour, who think, because they know how to make arms, that they ought also to be acquainted with the best modes of treating the wounds which are inflicted by them. The Parsees do not seem to have had much influence on the practice of medicine in India, or to have taken much interest in it until their more intimate association with Europeans. They had in ancient times a firm belief in spells and charms, and probably in medical, as in many other matters after they came to India, they received much more from the Hindu and Musalmans than they gave.

According to Darmesteter the Zoroastrians held that " sickness, being sent by Ahriman, the evil principle, ought to be cured like all his works by washings and spells, hence the medicine of spells was most powerful of all, although it did not oust the medicine of the lancet and that of drugs, yet it was more highly esteemed and less mistrusted."

There is one curious section in the Zend Avesta regarding the men who wished to practise the art of healing. It was laid down that those who used the knife were to operate on the worshippers of the Daevas first of all. If a man lost three patients in succession he was considered unfit to practise the arts of healing for ever and ever. If all recovered, he might then cut the orthodox who received Mazda and heal them at his will. The penalty for wounding the worshipper of Mazda before the surgeon became qualified was the same as was paid for wilful murder.

The orthodox Hindu, moreover, according to the Amrit-Sagar, was to try his skill with the lancet in the first instance on bladders.

The chapter in the Zend Avesta on fees is also interesting. A priest was to be healed for a holy blessing, the master of a house for the value of an ox of low value, the lord of a borough for an ox of average value, the head of a town for one of high value, and the chief of a province for the worth of a chariot and four. The fees for healing the wives of the above from the master of the house upwards were the cost of a she ass, a cow, a mare and a she camel respectively. Amongst those who used the knife or healed with herbs or the holy word, the last was the one who was best able to drive away sickness from the bodies of the faithful. Here, again, we see that to faith is attributed a higher power than the art of the physician.

I am informed by Mr. Vacha, the Principal of the Maharaja's College at Jeypore, that, before his countrymen put their faith in modern Western principles, they had *baids* and *hakims* of their own, the most famous of whom lived at Surat, and that certain Parsee families have at the present day the surnames of baid and hakim, which were adopted on account of the professions of their ancestors. In Surat and Broach there are still practitioners of the old school. Their knowledge is hereditary, as is the case with that of the ordinary practitioners, both Hindus and Musalmans, and they generally, he thinks, read Yunani books or rely upon manuscript works which have been handed down to them. Their knowledge is very inferior, though some of them become famous for the successful treatment of, perhaps, one or more diseases for which they have specifics which they are careful to keep secret, and not even to reveal to their sons.

One man at Broach was a *humbug* in other diseases, but could cure dysentery in three days; another at Surat was a famous bone-setter who rarely failed.

Mr. Vacha believes that the evil spirits mentioned in the ancient writings of his people really refer in an allegorical manner to the microbes, germs, or bacteria of modern science. Similar views were put forward in a brief sketch of the Zoroastrian religion and customs which was written by Mr. Bharucha, of Bombay, but these are only speculations which are, perhaps, not more valuable than those which declare that there are indications that electricity, and even illumination by means of gas, were known to Shakespeare and Milton.

There are, however, many notes of great suggestiveness and value in some of the old books, which show much enlightenment, as, for example, the following from Khorshod Yasht: "And when the sun rises up then the earth made by Ahura becomes clean, the running waters become clean, the waters of the wells become clean, ... all the holy creatures become clean." All bodily secretions are regarded as impure, as containing the germs of disease, and cleanliness and bodily purity (Yaozhdathra) form one of the chief commands of the Zoroastrian religion.

It is not at all surprising that with these ideas the Parsee are very appreciative of the advantages of modern sanitation.

It must not be supposed that *baids* and *hakims* have had it all their own way in India in the practice of medicine. The priests of all religions, as in Europe, have thought it their right to heal the sick, not merely by the use of spells, charms, and texts, but by drugs, and temples have long served as consulting rooms for the treatment as much of disorders of the body as of the soul. The most firm believer in a baid does not disdain to follow the advice of a *mahant* or religious leader, or of a *jogi* or devotee whose purity of life and habits of meditation are generally held to give him some insight into the causes, nature, and treatment of disease. In like manner the most pious Mussalmans, and particularly the women, trust in the charm which a sainted *moulvi* or *fakir* will write for a small coin and hope that it will aid the more regular exertions of the *hakim*, and this is not surprising when one knows that some of the most popular practitioners amongst them have been content to feel a pulse by holding the end of a long cord of which the other extremity has been fastened to the wrist of a distant patient in the upper room of a zenana or have framed their diagnosis on the inspection of a karura or flask of urine. There are many places where there are neither baids nor hakims, but only the village *buneah* or purveyor, the *dhai* or nurse, whose principal avocation is to assist children into the world, and the old men and women of the neighbourhood in whom is stored up the accumulated knowledge of the simples and folklore of the country side. Such is all the medical assistance, for example, that many of the poorest agriculturists throughout this great empire of villages, and the sick amongst the aboriginal tribes, ever have received. Some time ago I published a list of drugs and a short sketch of the medical procedure adopted by the Bhils in Meywar, and was much struck by the resemblance of the latter to similar accounts of the medical lore of the ancients and of rude people in other parts of the world. On this subject of parallel medicine I began to make some notes, but found the study scarcely worth perusing, that is, from a scientific aspect, though of great interest from another point of view. The early Egyptian papyri, Assyrian inscriptions, old Buddhist manuscripts, Saxon leechdoms, the works of many travellers and the guides to famous shrines in India, or the lucubrations of religious leaders, most of which are full of notes on materia medica, simples, etc., all contain much the same kind of information, which amounts, in most cases, to a grain or two of wheat deeply buried in a bushel of chaff.

Perhaps the belief for charms is the most potent of all influences just now among the vast majority of the people. In a chronic case a man will devote his whole time to a sick boy. Beginning with family recipes, he will next go to the *baids*, *hakims* and supplement their efforts with offering to the gods and in visits to their shrines which will be tried one after the other; sooner or later, finding no help in man, he sets out with his child for the house of a devotee or *fakir* of popular repute who tells him to do some simple, it may be even absurd, thing, or give some nauseous remedy or other, or breathes upon the child, and then at last the father may bring the worn-out sufferer to a dispensary, but too late as a rule for any useful treatment. I think this pretty accurately represents the state of things in India at the present day. It can easily be understood that under such circumstances the quack, whether Vaidic, Yunani, or European, has a magnificent field for the exercise of his powers. I have seen very little reference to this subject, but it is an important one, and is decidedly hurtful, not only to the progress of European medical science in this country, but to the reputation of even *baids* and *hakims*, of whom some good men, after their own lights, although in a greatly diminishing number, do exist. A few years ago only Holloway's pills and a few well known articles of the kind were advertised very extensively in this country. At the present time every post brings to the educated citizen quantities of European and American quack literature, much of it, I am sorry to say, of an indecent character, but it is outdone by the so-called Vaidic remedies which are described in nauseous pamphlets which find their way into the most remote parts of the country. The worst of it is that much of this rubbish is accompanied by certificates from men who ought to know better, who hold diplomas from our licensing bodies. The sale of patent medicines, a large number of them really quack products, unfortunately forms part of the business of many of the medical halls in the large towns. I only mention this as a warning to practitioners, because the use of such articles can only tend to make patients, after a time, distrust the physician in whose skill as a prescriber they naturally soon lose faith.

Having given this necessarily very brief sketch of the Indian schools of medicine, and of the treatment of the sick in past times as well as the present day, it is necessary now to consider why these systems have decayed, and yet still have such a hold on the faith of the inhabitants of this vast empire, and then go on to ask whether we have any lessons to learn from them and from their success so far as it goes, and also discuss what should be done to promote the knowledge of, and belief in, that which we hold to be a more rational, because a more scientific, mode of practice. I think that it must be at once admitted that as long as dissection was practised the Brahminical Hindu surgeons and physicians were quite as advanced in the knowledge of their art as their brethren in other parts of the world. They were good observers and careful recorders of natural phenomena, but as soon as they allowed the religion of the Puranic period to interfere with them by its dictum that dead bodies were not to be examined, they lost the only means of testing their observations of true advancement.

To the same defect was due the want of progress of the hakims, who, when they adopted the works of Hippocrates and Galen, had a good foundation upon which much might have been built up. The onward march of medicine in Europe was prevented by the same unfortunate prejudice.

Next in importance comes the too great reliance on religious interference, on the idea which has been generally prevalent that disease is a demon which must be exorcised, propitiated or expelled by *mantras* or charms and sacrifices, or by cabalistic practices, and by the deprivation of nutriment through starvation of its host or victim. Most of us will recollect the story of the famous surgeon in the Bagh-o-Bahar who opened the head of a demented youth and relieved him by removing from the surface of his brain a centipede which was devouring that organ.* I have drawings in my possession which were taken from a work on elephants in which each disease is represented by one or more animals who torture the poor beast by sucking its blood at the affected parts or by pressing them violently, as when a snake of fearful size, for example, by coiling itself round the animal's trunk gives rise to frightful neuralgia of that organ.

The wonderful and elaborate working of the ordinary Indian minds which makes so much of details also finds expression in medicine in the preparation of most complicated prescriptions, such for example as *churans* or powders which contain ten or twenty ingredients, or it sees a fancied connection between the shapes of certain vegetable drugs and diseases. Complicated formulæ of this kind, of course, prevent the results of remedies from being studied with any degree of accuracy, and here, again, we have only an evil which existed in Europe at one time and had the same results. I remember seeing an old edition of the London Pharmacopœia which was still consulted when I was a student, though it gave recipes for making the celebrated Venice treacle which contained, perhaps, three score or more ingredients, some of them of a most nauseous character. So poorly is the Indian physician paid by the great majority of his patients, in comparison with the sums lavished on feeding Brahmans and beggars, or on expensive drugs recommended by worldly wise priests and the less conscientious members of his own profession, that it is not wonderful that men of the best powers now rarely practise medicine. There is a convenient, but pretty general, idea that the good hakim or baid should be satisfied with a pittance from the State, and for the rest be content with the consciousness that his art is a charitable one which will be rewarded in another world if he is not sufficiently paid by the thanks and blessings which attend him here.

It has thus come about that much learning is not looked for in the baid or hakim, though the former is burdened with the necessity of reading all his books in Sanskrit, and as regards the latter, one may well believe the truth of the story that all the qualifications that were required in the son of a late hakim who lived in a great city were that he should carry his father's staff and promise to read his books.

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* The original story may be found in the Bhojopralandha of anecdotes connected with Bhoja Raja of Dhar. Translated by Pandit Vidyasagara.

So much for the decay of the indigenous systems, and yet, decayed as they are, and notwithstanding that educated Indians are fully aware of the immense help which is derived from such modern scientific instruments as the microscope, the stethoscope and the clinical thermometer, they still undoubtedly have much influence in the country.

To what is this due? I think to the prevailing idea that the European constitution is so radically different from the Indian that what cures disease in the former is in the latter either deleterious or effective to a belief in the systems of philosophy which accord with the Indian systems of medicine, so that the patient understands the lines of argument and practice of his fellow-countrymen and co-religionists, whereas the views of the Europeans are a mystery to him; to the fact that the baid and hakim use drugs and recommend articles of diet which are well known to the patient, and, therefore, in his opinion, devoid of anything which may defile him; to the consideration which is naturally shown for all his many prejudices and beliefs; to the feeling that after all we can have something to say in his own treatment and adopt that which commends itself to his judgment as being most likely to succeed; to the patience with which his lengthy story of his ills is heard; to the high fees which even hospital assistants expect; and, lastly, I believe to the fact that the patient generally has to do some great thing in the way of abstention from luxuries or pleasures, and to take nauseous drugs which give him the sense of getting something for his money. With regard to religious belief and prejudice, I consulted a friend, Rao Bahadur Thakur Govind Singh, the premier noble of Jeypore, whose views are interesting and instructive. He states that the Dharma Shastras lay down that men are subject to different diseases on account of different sins committed in previous births. If the sin is trivial the disease (Karma-Roga) can be removed by the exercise of charity. They are also afflicted by changes in the three humours which are due to irregularities of diet or exposure to heat or cold. Such diseases (Dosh) may be cured by the help of medicines. A third class of disorder arises from both causes combined, and may be removed by the practice of charity and use of drugs. When a baid is called to see a patient his first duty is to find out the cause of his disorder, and if he ascertains that it arises from any of the irregularities which have been described he commences his treatment. Should he fail he at once advises the use of charity, as it is evident that the disease arises from past acts of sin. Should a favourable result not follow it at once becomes clear that the man's past sins have been too great to admit of present relief. These ideas are naturally much in the baid's favour, as it is difficult for him to become discredited, while the priests and poor are all on his side. Babu Kali Pada Banerji, the Principal of the Sanskrit College at Jeypore, has also kindly given me an account of the education and position of Hindu physicians, which I attach as a note to this paper. He observes that medicine is nowhere taught in India in the vernacular, hence much time is spent in the study of Sanskrit, with which language few baids in the present day become really familiar. Only books are used and there is no general practical education; pupils pick up what knowledge they can of the symptoms and signs of diseases by seeing patients with their masters, from whom they also become familiar with the use of drugs. The teachers say that a knowledge of anatomy is not required in medical cases, as it is only necessary for treatment to be acquainted with the symptoms of the different diseases as laid down in books.

The principal of the college, Mr. Vacha, also adds that the study of medicine is entirely hereditary, and the tuition confined to instruction of a son or pupil by his father or master, who never teaches all that he himself knows, but always reserves one or more great secrets for his own advantage.

The foregoing remarks give us some indications of what is needful to popularize our own system.

In the first place I think we should try to lessen the prevailing ignorance of anatomy and physiology by giving popular lectures or demonstrations which should be illustrated by the magic lantern or pictures, by exhibiting anatomical models in our museums, by encouraging the publication in the vernaculars of very simple works on the subjects I have indicated, and on hygiene. These works should generally be pamphlets with rough drawings or coloured pictures which the people understand better than elaborate English prints. We should take every opportunity, not only in such lectures and books as I have described, but in our practice and conversation, of explaining why a certain course of treatment is followed, and of assuring the people that our drugs do not contain anything which is prejudicial to the religion or caste of all classes of Indians. It is easy to show that the best Hindus and Musalmans find nothing in the European systems which is repugnant to their respective creeds, and that success in the practice of them does not depend upon the use of wet or dry medicines, or the solution of drugs in alcohol, or in forcing a man to adopt unaccustomed kinds of diet. At the present moment most Jains reject medicines unless they are given as dry powders, and many Hindus and Mohamedans fear that alcohol may be administered to them in some form or other. We should, therefore, be careful to have no secret remedies. It would astonish many Indians if it were demonstrated to them that many of the crude compositions of their pharmacopœias are given in a far purer, and therefore more exact and reliable, form by Europeans. In short it may be truly said that our system has everything to gain by publicity and discussion, whereas the indigenous ones assuredly lose, when light is thrown upon them and the atmosphere of mystery which surrounds them is dispersed. As regards most of the other reasons for success of the indigenous systems which I have advanced, it is clear that we can learn much from them.

We must respect prejudices when they are not harmful; we must be prepared to give reasons for our practice, and exercise more patience, and spend more time on individual cases; we must study the diet of the Indian in health as well as in sickness, and we must be careful not to prescribe the so-called patent medicines, or to make too much use of routine formulæ, but show that we understand the action and combination of drugs, as all Indians have great faith in medicines, and cannot understand the physician who makes light of them. Success in practice depends upon keenness of observation, upon letting nothing, however trivial, escape notice, and we may learn much, I think, in this respect from the old-fashioned conscientious baid, who is usually acquainted with the action of a great number of simple vegetable drugs, and is very minute in his investigations, although generally mistaken as to his interpretation of certain phenomena, such for example as the pulse. The "Amrit Sagar" says the good physician should be able to finger the pulse as a skilled performer plays upon the vina or harp.

Lastly, in my opinion, great efforts should be made to put down quackery of all kinds, especially of European origin. No quack or patent medicine should be allowed to be sold or advertised unless its composition is made known and printed on the label of every box or bottle in which it is sold. It should be easy to apply this law to European products, and then it would not be difficult to deal with the so-called Vaidic and Indian articles. Both should be heavily taxed. A Medical Act should be passed by which only qualified persons should be allowed to practise European medicine, so that the art may, at all events, be presented in its true colours; and here, again, I believe there would be a strong feeling among Indians that no one should be allowed to practise as a baid or hakim who had not passed a fair test, which in time would be gradually made more difficult.

The whole question resolves itself into a patient struggle between ignorance, prejudice, custom and superstition on the one hand, and knowledge, enlightenment, and science on the other. *Magna est veritas et prevalebit.*

The outlook is not discouraging, as the increasing attendance at our hospitals and dispensaries everywhere shows. More advance in public estimation has, of course, been made in surgery because results are so evident, but medicine has had its triumphs, and more especially the preventive branch of it. I will conclude with only one warning, and that is that we should be content to proceed slowly if we wish for ultimate success, bearing in mind that the habits and beliefs of ages cannot be changed in a day—no, not even in a century.

APPENDIX.

Sanskrit College, Jeypur, 28*th October*, 1894.

Dear Sir,—In reply to your kind note of the 18th instant, I beg to inform you that most of the notable ancient Sanskrit medical works form the curriculum of studies in the Sanskrit College here. At the Upadhyaya (Proficiency) Examination in Ayurveda (Medical Science) the following are the text books:—

Nidan, the great work on the diagnosis of diseases, by Madhav Acharya.

Narivijnan, a tract on feeling the pulse, by Ram Charan Das.

Bhavaprakas, a later compilation of medical work, by Bhava Misra.

Paribhashapradip, a book on the Hindu Materia Medica, by Govinda Sen.

Chikitsa Sara Sangraha, an ancient compilation from Charak and Susruta, by Chakradatta.

Rasamanjari, an elementary treatise on chemistry, by Bsali Nath.

At the Sastri (Honours) Examination the text books are:—

Bhavaprakas, as at the Upadhyaya Examination.

Astangahriday, a work on the diseases of the heart and the whole body, by Bagehatta.

Susruta Sanhita, Chapter on the body.

Charak Sanhita, Chapters on treatment.

Rasendra Sara Sangraha, a work on chemistry, by Gopalkrishna.

At the Acharya (Final) Examination, the text books are:—

Susruta Sanhita.

Charak Sanhita.

Ashtangahriday of Bagbhatta.

Bhaisajya Ratnavali, a modern Hindu pharmacopœia.

Rasendra Chintamani, the best work on the chemical or mineral drugs, by Ram Chandra.

I may add here that these are the Sanskrit medical works generally studied also at Calcutta, Benares, and other parts of India. There are besides these many other famous Sanskrit works on medicine, namely, Sarangdhar, Sanhita Atreya Sanhita, Harit Sanhita, Vira Sinhavaloka, etc., too numerous to mention. But they are not much in use at present.

2. The titles conferred here in the medical examinations are *Bishak* at the Upadhyaya, *Bhishagwara* at the Sastri and *Bhishagacharaya* at the final examination. But the titles conferred in Bengal are Kaviraja, Kavirajan, Kanthabharan, and Dhanvrintah; and in the N. W. Provinces Vaidya, Vaidyaraja, and Vaidyachuramani. I must mention in this connection that nowhere besides Jeypore Hindu medicine is systematically taught in the College; and that everywhere else the science is taught privately by distinguished native vaids.

3. To complete the whole course of medical study in the Sanskrit College of Jeypur it takes a boy no less than a period of ten years, after which he is expected to pass the highest examination in medicine and can be said to possess a competent knowledge of the Ayurveda.

4. Charak and Susmta are, as far as I am aware, being translated into English by Kaviraj Avanish Chandra Vidyaratna of Calcutta. No other Sanskrit work has yet been known to me to be rendered into English.

5. Medicine is nowhere taught in India in the vernacular, medical education being everywhere given

entirely in Sanskrit. The medical works in Hindi, such as Amrit Sagara by Maharaja Pratapa Sinha, of Jeypur, &c., as well as those in Bengali, are never made use of by the vaids of even the commonest efficiency.

6. Hindu medical education is given by the vaids in India entirely from books, dissection of dead bodies being everywhere considered unholy. It is needless to state that the modern progress in the science of anatomy made in Europe is, therefore, almost wholly unknown to them. The native vaids, however, consider themselves well up in diagnosis and treatment of diseases, even without any knowledge of it; for they say symptoms of diseases are quite sufficient, except only in complicated surgical operations, to enable the physician to deal with cases successfully. All possible care is taken by them to make the pupils conversant with the symptoms and diseases by seeing patients in company with themselves, as well as to render them familiar with the herbs and drugs used.

I believe I have now put down all the information you want. Any further information on the subject you may be in need of I will be very glad to furnish you whenever required. Yours very truly—Kalipada Banerjee.

THE HISTORY, PATHOLOGY AND PREVENTION OF FRAMBŒSIA, COMMONLY CALLED THE PARANGI DISEASE OF CEYLON.

BY W. R. KYNSEY, F.R.C.P., C.M.G.

The existence of an obstinate disease, locally named parangi, has been known to be endemic in different parts of Ceylon for centuries, and its history, symptoms, treatment, influence on health and longevity of the population, and whether it is in any way connected with syphilis, have been the subject of much anxious enquiry and report, not only in Ceylon by the officers of the Civil Medical Department, but in other countries where a cognate or essentially identical, although differently-named, disease is prevalent.

The term parangi is a corruption of farangi (there being no *p* in Sinhalese *f* is substituted) to indicate a disease of foreign origin, a new disease imported by strangers into the island. There is, however, no record or tradition respecting any such importation by the Portuguese, who were always spoken of as Faringees, no doubt a term of contempt by the natives.

Under the colloquial names of yaws, pian, bubas, coko, &c., parangi is a well known affection in the West Indies, West Coast of Africa, South America, Batavia, Fiji, and recently the disease has been described in Assam. My belief is that it exists at the present day in most tropical countries and in some parts of Europe.[*] In medical treatises it is named frambœsia, a term invented by Sauvages.[†] In his Nosology for a disease which he describes as:—

> "Fungi coloris rosei vel pallide rubri, granulosi, seu papillis exasperati, muco ruffesente continuo madidi, nulli ulceri, sed cuti adhærentes."

Yaws, known as "button scurvy"[*] or morula, was very prevalent in Ireland a hundred years ago. Dr. (afterwards Sir) Dominick Corrigan gave a clinical lecture on the disease at the Charitable Infirmary, Dublin, fully reported in Vol. 2 of the *London Medical and Surgical Journal* for 1835, in which he points out that an opportunity may not occur again for seeing a case of this singular disease. The last record I can find of a case of button scurvy is in Vol. 2 of the *Lancet* of 1851, in which Dr. Kelly of Mullingar reports one; yaws was also prevalent in Scotland, known as sibbens or sivvens a century ago. The disease is described in Dr. Craigie's Practice of Physic. As usual the symptoms of several different affections are mixed up in the description given. Dr. H F. Autenrieth,[†] a German Physician, who travelled in Scotland in 1823, states that fifty years before he wrote sibbens was a perfect plague, but that it had (in 1823) disappeared except from the west and north. He said that the disease was so contagious that it could be communicated by a simple touch, and in rare cases by the breath of the patient, and that with respect to external appearance and curability it was scarcely to be distinguished from the venereal disease. He was shewn some cases which he describes, and which were evidently not sibbens but its sequela lupus. In Sweden and Norway the term radesyge no doubt included yaws. Some suppose that yaws was the disease which the Israelites suffered from in their journey through the desert,[‡] and that saraat, usually translated leprosy, really means yaws, in the same way that sahafate or safet of the Arabian physicians,[‖] which is frequently translated syphilis, should really be taken to mean yaws. For a long time leprosy and yaws were considered to be related to each other, but it is now admitted by all, having any acquaintance with the two diseases, that this is not so. Corrigan in the lecture on button scurvy, to which I have previously referred, says: "Yaws has been supposed by some to be a variety of the leprosy of the East, and, if so, the persistence to the present time of a similar disease in Ireland, and in Ireland I believe alone of the countries of Europe, may afford more than a fanciful support to the supposition of the Eastern descent of the ancient inhabitants of Ireland—a supposition so strongly supported by the antiquities, the customs, the remnants of Eastern rites, and even the names of places still preserved in this country.

In considering the existence of certain endemic diseases in different countries and the question of their identity with yaws it is remarkable:

(1) That the eruption is generally likened to some fruit, usually a strawberry. Yaws in the vernacular in parts of Africa means raspberry. Pian is a strawberry. Swin is Celtic for raspberry, hence sivvens. Frambœsia of course comes from Framboise, and morula from morus, a mulberry. In Ceylon the eruption is said to resemble the fruit of the *Ficus glomerata* (*Udumbara* in the vernacular).

(2) That the disease, like syphilis, is frequently attributed to importation, into the West Indies by African slaves, into Scotland and Ireland by Cromwell's soldiers, into Ceylon by the Portuguese, into Sweden (Radesyge) by the troops which returned after the Seven Years War.

(3) That it is frequently confounded with syphilitic affections.

(4) That the disease disappears slowly but surely, corresponding with the advancement of civilization and

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[*] Greece, Turkey, the Islands of the Levant, *vide Lancet*, August 1883, page 337.

[†] Nosol method Amstelod, 1768, Tom II., page 551.

[*] From its resemblance to a Page's Button. Scurvy, a name given to all skin affections.

[†] Untersuchungen uber die Volkskrankheiten in Grossbritanien U. S. W. Tubingen, 1823, 132.

[‡] Leviticus, chapter XIII.

[‖] Ali Abbas. Hirsch Geograph. Pathol, Vol. 2, page 3, Syd Soc. Ed.

the improvement of the dietetic and other hygienic conditions of the people.

(5) That no doubt formerly under the term yaws, parangi, &c., several diseases, frambœsia, syphilis, lupus, &c., were included which has given rise to much confusion in studying the symptoms. As Bacon truly said *citius emergit veritas ex errore quam confusione.* Even at the present time in Ceylon at least two diseases are included under parangi—

(1) Frambœsia,

(2) Lupus,

and although I have given much thought and study to the subject I am not in a position to state definitely the relation which exists between the two. The disease known to medical writers as frambœsia, and in Ceylon as parangi, may be defined as a disease *sui generis* marked by an ill-defined period of incubation followed by vague premonitory symptoms, such as slight fever which may be accidental, muscular and articular pains which may be severe, scarcely perceptible or absent; and the evolution of successive crops of a characteristic eruption which runs a definite course. It is propagated by contagion, the virus entering through an abrasion or sore. It attacks irrespective of age, race or sex, yields readily to early and appropriate treatment. As a rule, it does not interfere with the general health, and an individual may be attacked more than once.

Although the duration of the above-defined disease may be as short as three months, it is usually much longer; the cases may be described as acute or sub-acute, the eruption coming out in successive crops, but each crop may consist of only one, two or many tubercles. In a variable period, which may be months or years, or in most cases not at all, frambœsia is followed by chronic ulceration, the nature of which is not settled. It may be that the neoplasm and the organism which produces it infiltrates the surrounding tissues and long afterwards excites destructive inflammation, occasionally involving even the bones, or that lupus attacks the individual, the connection between the original eruption and the subsequent ulceration being in harmony with the well-known fact common to the animal and vegetable kingdoms that feeble individuals, or feeble parts of an individual, are most readily invaded by parasitic fungi. A part having been once the seat of inflammation is left in a weakened or impaired state and is more liable to a second attack of inflammation as it has less resisting power. The skin after frambœsia is in this state, and would be easily attacked by the tubercular bacillus, producing the disease known as lupus. Whichever of these views is adopted, there can be no doubt that persons who have gone through the eruptive disease (frambœsia) are more liable to be attacked by ulceration, which in my opinion is the result of the lupus process.

The initial cutaneous lesion consists of papules, at first about the size of a pinhead or mustard seed, appearing under the epidermis surrounded by a dark halo. The papules appear on all parts of the body. The top of each papule acquires a yellow tint, and it slowly developes into a tubercle; the yellow top also increasing in size. This yellow substance, which is neither lymph or pus but the secretion of the sebaceous follicles, escapes and forms dome-shaped rupia-like crusts, which are reproduced after removal. When a crust is removed a mass of granulation tissue or "proud flesh" is exposed beneath, covered with a creamy secretion, and it is this appearance that is said to be so like a raspberry or strawberry. But it would be difficult to imagine anything more unlike the original. The tubercles under favourable circumstances disappear by interstitial absorption in about six weeks, and the crusts gradually become brown and thin and then fall off, leaving at their sites maculæ or dark spots which may persist for years. Instead of absorption the tubercles may ulcerate, the ulcers being shallow and covered with crust. The dark spots which mark the sites of a previous eruption are due to the long-continued congestion. The red corpuscles which escape from the vessels break up and are absorbed, while some of the altered blood pigment remains behind, and causes brown colouring of the skin.

Frambœsia is evidently caused by a virus which acts on the skin producing new growths of the nature of granulation tumours, closely resembling, but with which they have no connexion, the syphilitic chancre. The diseased process is a chronic dermatitis. The structure of the tubercle is very simple—"a plasmosis of the cutis complicated with great proliferation of epithelium and hyperkeratosis." If a vertical section be made through a papilla with a yellowish apex, it will be seen that the latter is the stratum corneum of the epidermis increased and thickened to three times its natural size. The crusts consist of a dried mass of sebum, granulation and prickle cells, and the secretion which covers the papilla of granular and prickle cells. The rete mucosum is much thickened and contains granulation cells. The papillæ are considerably increased in size by swelling and proliferation of the connective tissue and cell infiltration; they are raised considerably above the level of the skin, and also penetrate deeply into the corium. The vascular network of the papillæ and sub-papillary tissue are widely dilated and have a tortuous course. The corium, especially its papillary portion, is very much thickened. The hair remains normal during the whole course of the disease. The sebaceous follicles are enlarged and secrete an unusually large quantity of sebum, which gives the yellow appearance to the crusts. The ducts of the sweat glands are twice as wide as normal, and their endothelium is increased. The arrectores pilorum are hypertrophied and the deep muscles of the skin are found in the same condition if the tubercles are large. Granular cells which are really only white blood corpuscles are found wherever the disease process exists. When the tubercles begin to retrograde they become covered with whitish scales, and the granular cells and the uppermost cell layers of the thickened stratum mucosum begin to dry. The granular cells in the corium break down and are absorbed, the enlarged papillæ sink gradually to their normal size, and finally only a dark spot marks the site of the frambœsia tubercle.

The cause of the pathological process is not known. By ordinary methods and reagents no specific organism has been discovered. The streptococci and staphylococci which simply swarm under the crust and help in its formation by inducing fibrinous exudation and leucocytosis are deuteropathic.

If the tubercles break down and ulcerate, which is not usual, except in weakly subjects, the ulcers formed are shallow and covered with a yellow or brown crust. After healing a cicatrix marks the site of each.

The process is genuinely inflammatory and non-syphilitic. Dr. M. Charlouis* of Samarang, Java, undertook a series of researches to determine the contagion of frambœsia, and it is needless to observe that the experiments which he performed would not be allowed, I am glad to say, in any country under British rule. He selected four patients with well marked eruptions of frambœsia, and with crusts and blood obtained from the fungous tumours in various stages of development on their bodies inoculated a number of persons, *viz.*:—

(a) The patients themselves from which the matter was taken, each with secretion from his own sores.

(b) Two of the same patients with each others' secretions.

(c) Thirty-two prisoners, all Javanese with the exception of one Chinese, all healthy and perfectly free from frambœsia.

(d) Ten Malays who formerly had been affected with frambœsia, and still had pigmented spots and a few cicatrices.

The results obtained were as follows :—

(1) Of the four patients auto-inoculated three gave good results, the inoculation by both blood and softened crusts slowly produced characteristic papules, which gradually enlarged into tubercles, and became covered with rupia-like crusts, on the subsequent removal of which papillary growths were exposed, which were rapidly covered with new crusts. The inoculations had no influence on the further course of the disease. New tubercles appeared on the disappearance of the old ones.

(2) Of the inoculation of the two of the four patients with each others secretions, only one succeeded, a fungous growth with the peculiar crust resulting.

(3) Of the 32 persons inoculated who had never been affected with frambœsia only four failed, among whom was the Chinese prisoner. After the lapse of 14 days, papules made their appearance at the seat of inoculation, each surrounded by a red halo. Six days afterwards pustules slowly developed, crusts subsequently formed, on the removal of which the characteristic fungus was seen. In most cases the symptoms of frambœsia shewed themselves three to five months afterwards. In all the cases the patients complained of painful glandular swellings the same as occurs after the inoculation of syphilis.

(4) Of the ten Malays inoculated who were already affected with frambœsia, seven succeeded admirably, but the general eruption did not appear for five months. These inoculations were made to decide whether one attack afforded immunity from further attacks. Charlouis came to the following conclusions from these experiments—

1. Frambœsia is a contagious disease.
2. It is both auto and hetero-inoculable.
3. The same person may be affected more than once.
4. Frambœsia patients inoculated either with their own or the products of others acquire, at the point of inoculation, either in ulcer resembling an *ulcus molle* or a fungous tubercle; these inoculations exercise no influence whatever on the course of the disease.
5. The secretion and the blood of a tubercle are infective, and the results are exactly the same.
6. The virus is a fixed contagium, and contagion is only possible by actual contact.
7. The products of tubercles *in stadium incrementi* and *acme* alone are infective, and that as soon as the tubercles begin to shrink and dry, infection is no longer possible.
8. The period of incubation lasts from three to five months.
9. Fever, accompanied by gastric disorders, and pains in the bones, precedes, and for a considerable time accompanies the eruption.
10. The place where the frambœsia poison finds access to the body may be at an early stage distinguished by painful glandular swellings in the immediate neighbourhood."

Another more important question Charlouis tried to decide was whether frambœsia is a peculiar form of syphilis or a disease *sui generis.* Alibert was the first to give expression to the former idea, and many since have accepted his views.

I will give what he says on this subject, and the experiments he made in his own words :—

" It is a fact that many things in frambœsia reminds one of syphilis.

1. Both are contagious diseases.
2. Both have a fixed contagium.
3. The incubation lasts in both from three to six months.
4. Both begin with fever and dolores osteocopi.
5. Both manifest themselves as cutaneous infiltration.
6. Polyadenitis universalis occur in both.
7. Both are healed by the same drug.

There are other reasons, however, which make us believe that frambœsia and syphilis are very different diseases, very distinct from each other.

1. The place where the frambœsia infection occurs shows always an *ulcus molle*, whilst in syphilis sclerosis of the *ulcus* always takes place, which is of great diagnostic importance.
2. Frambœsia never begins in the form of spots, as is mostly the case in syphilis.

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* Polypapilloma Tropicum (Frambœsia) Ceylon Medical Journal. Vol. IV., No. 4, translated by Dr. Macdonald from Vierteljahrsschrift für Dermatologie und Syphilis, 1881, VIII, 431.

3. It is only in rare cases that framboesia disappears within a few months, its course lasting a year or more, whilst the symptoms of syphilis disappear comparatively quick.

4. Framboesia never passes into ulceration except by external injuries, whilst syphilis always does so.

5. However long framboesia may exist, the constitution of the patients never suffers, whilst the very opposite is the case in syphilis.

6. Framboesia always remains limited to the skin and mucous membranes, and it is only exposure to injuries, as on the soles of the feet, which cause it to penetrate deeper. In such cases the course is that of an ordinary ulcer, and the destruction of tissue is rather due to the injury than to the disease.

In syphilis all the organs and tissues of the body may participate. Further the auto-inoculation of framboesia shews that the disease is not syphilis.

Although I was cognisant of these facts, I determined notwithstanding to prove by direct experiment that framboesia was not syphilis. I made choice for this purpose of only one individual, as I dared not expose several to the danger of syphilis.

Before the experiment I communicated to the patient the possible results of the inoculation to leave him free to act as he liked. Of his own accord he submitted. A patient who had framboesia was inoculated on the 3rd May, on the right breast, with the secretion of a hard chancre, and on the 1st June a hard chancre was found at the point. At the end of 3½ months he had a syphilitic eruption over his whole body. The framboesia tubercles, which he had at the same time, were not in the least modified by the syphilis. About this time a Malay named Jasmo, 26 years of age, in good condition, came under my treatment: he had for some time a framboesia eruption over his whole body; he did not wish treatment for this eruption, but asked to be treated for a hard ulcer in the sulcus retroglandularis which he had lately acquired, as he said, by sleeping with a woman who had the disease. In order, however, to be perfectly sure of my diagnosis, I allowed the hard ulcer to run its course without treatment. The ulcer left behind for a considerable time a hard base which ulcerated anew from time to time. After this patient had been nine weeks under my observation, there appeared over his whole body a maculo-papular syphilitic eruption with opaline plaques in the mouth and round the anus; this case distinctly shewed that syphilis and framboesia are not identical diseases."

The parangi disease will disappear after a time like the button scurvy of Ireland, and the sibbens of Scotland with improvements in the sanitary, industrial and social condition of the people, with the introduction of better food and good water, and increased attention to personal and domestic hygiene. The medical profession often blamed and little thanked, but ever foremost when any work in the interests of suffering humanity has to be done, has spent thought, and encountered trouble in every country in the world to alleviate distress and suffering and to redress wrong. But in the disease I have discussed, we can do little more than alleviate and indicate how it is spread. The larger problem of prevention is a politico-social and economical one, the solution of which rests with those in power, and consists in the introduction of all means which can cause a general amelioration in the condition of the people. Foremost among these is the opening up of the country, by roads and railway communication and drainage by canals. The repair of ancient tanks and the extension of irrigation for the larger cultivation of the soil and the improvement of the water-supply, the introduction of improved methods of agriculture which are sure to result in additional and better varieties of food than those now in use. In no country has more been done than in Ceylon of late years by the wise irrigation policy of the Government.

The result of careful enquiries into the natural history of the endemic disease of Ceylon which has long caused, and still continues to cause, so much suffering and misery among the rural population in many districts may be set forth in the following conclusions:—

(1) The real nature of the malady has for all practical purposes been ascertained; its chief favouring causes determined; and the remedial measures for its mitigation and final extinction made manifest.

(2) The disease is essentially the same disease as the yaws of the West Indies, the true characters of which are now far better understood than they were some years ago.

(3) The disease is the offspring of a depraved condition of the blood, a *dyscrasia*, manifesting itself by loathsome eruptions on the skin, which if neglected or mistreated are liable to be followed by ulceration and much constitutional disturbance, great suffering, emaciation and finally death.

(4) What appears to be the main cause of this depraved condition of the blood in early life, for at this age most of the cases occur, is the food of the mother and child which produces cachexia, with which all the future morbid symptoms are connected. The disease does not occur among the well-conditioned classes of the community, and the effects of an improved dietary are rapidly to accelerate its therapeutic cure.

(5) The quality of the food of the ordinary rural labourer as regards wholesomeness and nutritive value cannot but be detrimental to the formation of a perfectly healthy food. The only animal food that is used consists almost entirely of salted fish; fresh meat is rarely taken, neither are eggs or milk in common use. That such a dietary should give rise to an unhealthy state of the system, in which various maladies of the skin are apt to be developed, can surprise no one.

(6) Of equal importance with food is the unhealthy influence of the manifold insanitary evils in and round the dwellings of the people. The water for drinking purposes is as a rule impure, frequently derived from small tanks

in which animals lie, and which the people use for bathing and ablutionary purposes. The area of the disease is the same as that of bad water. There is frequently much overcrowding and little ventilation. The influence of these surroundings and food must be detrimental to the processes of digestion and assimilation and the formation of perfectly healthy blood.

(7) But as all persons exposed to bad sanitary surroundings and to the use of inferior food do not suffer from parangi the *causa causans* has still to be sought, and it will no doubt be found, judging from analogy, to be a micro-organism which gains entrance to the body through some open wound on the surface.

(8) The disease is contagious. As a rule a person is only attacked once. It is perfectly and easily curable if treated properly and at once; it is not hereditary, and has no connection with syphilis.

(9) From the above conclusions the indications for prevention are self-evident, and consist in the early and complete separation of the sick from the healthy, the improvement of the food, water-supply and amelioration of the condition of the rural population.

PARANGI.

BY JOHN ATTYGALLE, M.D.

THE term parangi was till very recently often used in Ceylon to denote many affections, such as syphilis, leprosy and other skin diseases, but separating all these well-recognised forms of disease, there is a peculiar malady prevalent very extensively in certain parts of that island to which also it is applied. It is a disease, though possessing some characters in common with these, yet sufficiently distinctive from them, as to be entitled to a separate place in our Nosology and to this alone is the term parangi applied in this paper.

The disease probably was not one unknown to the ancient Sinhalese, and has been prevalent in the country from a long period, and probably included among the 18 forms of skin diseases mentioned by native writers on medicine, which they ascribe to such fantastic causes as the "ire of the gods and sins committed in previous births." From the very meagre description given in the native medical works of these skin diseases, it is difficult to ascertain to what particular form of them the term parangi is now applied, but I think it permissible to conclude that it is the *Udumbra Kusta* of the old native writers, so named from the resemblance of the primary eruptions to the fruit of the *Ficus glomerata*, which is also a peculiar feature in the character of the eruptions of the disease under consideration.

It is not out of place to enquire here how the term parangi came to be applied to this disease, for it must be borne in mind that no such disease is mentioned in any of the native medical works written before the landing of the Portuguese in Ceylon. I think this is easily explained. The term parangi literally means foreign, and is derived from the well known appellation *Ferange*, by which all Europeans are known throughout the East. The Portuguese, the first European settlers, were and are still known in Ceylon as parangi, and it would seem, if one could trust to such a loose writer as Captain Reheiro, an officer in the Portuguese army of occupation in Ceylon, and who wrote an account of the island about the year 1637 A.D., that the "Neapolitan disease" (syphilis) was called Parangi Lede, *i.e.* Portuguese sickness by the Sinhalese, from a belief that it was brought into the island by the Portuguese. It is not known whether syphilis was prevalent among the Sinhalese before the advent of the Portuguese, but whether it was or not, there is no question that it was prevalent to a very great extent among the new comers so as to be thought a disease peculiar to them. In process of time all diseases which had some characters in common with syphilis appear to have been denoted by this term parangi, hence giving rise till lately to the confusion which prevailed among medical men in Ceylon as to the classification of parangi disease as understood at the present day, and in the view held by them regarding its nature, some considering it to be a form of syphilis, others leprosy, elephantiasis or a combination of two or more of them.

Characters of the Disease.—The usual period in life of the first appearance of parangi is from the second or third year to the age of puberty. It commences by a single sore which has been termed the initial sore attended with more or less febrile symptoms and followed by an eruption composed of small papules situated beneath the skin. The initial sore usually is the result at the first instance of an injury, or scratching of the part, and it assumes after a time a peculiar character almost simultaneously with the eruption indicative of the disease. It is very intractable to treatment, is the last to heal, and not unfrequently degenerates into one of the forms of sequelæ (Aramane Wane) which will be described further on. The papules are succeeded by pustules and tubercles, which rise up abruptly from the surface of the skin unmarked by any inflammatory action or swelling in the surrounding parts, and not infrequently they are clustered together in large patches. They vary in size from a pea to a walnut more or less, and come out in successive crops in various parts of the body, but especially upon the legs, arms, nates and neighbourhood of the arms, face, around the mouth and sides of the chest and abdomen. The pustules burst and become quickly covered with prominent dry, yellowish, rupial-like crusts or scabs, upon the removal of which a raw flesh-like surface of the ulcer is exposed. It is frequently raised above the level of the surrounding skin and furnishes a thin slight purulent discharge.

The eruptions last about six months and disappear, leaving the patient apparently well, especially if he be young and healthy. Whether it is a natural process of the disease itself, as in other eruptive diseases which run a certain course, such as small-pox, or the result of remedies employed by the natives, which they always do in these cases, cannot be stated with certainty; but when they are treated in hospital by European practice, they recover in a much shorter period. It is the belief among natives that to cure the disease before the eruptions are well developed is attended with sequelæ, and the remedies employed by the native doctors in the early stage of the disease are always intended to encourage their development to the fullest possible extent. After the eruptions have disappeared many persons remain without much inconvenience all their lifetime, except perhaps occasionally suffering from pains in the bones and joints.

In a great number of cases, however, if the general health becomes vitiated, nodes form in the bones with gummy tumours, followed by indolent abscesses which frequently break out into open ulcers. These ulcers are peculiar, their edges irregular, have a dead, pale look, and discharge a thin ichorous fluid. They cicatrise in some parts, whilst breaking up and extending in others, so that frequently the whole extent of a limb is affected in this manner. These ulcers almost invariably are accompanied with what the patients call "running pains" which are more severely felt at night than in the day time, and are often of a most excruciating character. They are described as "falling into the ulcers," and when this happens a marked change in the appearance of the latter takes place. The ulcers which are cicatrising become very irritable and painful, granulations assume a pale and flabby aspect, and in some instances show a tendency to bleed, and the cicatrices, which had been formed, break up. As the disease advances, to quote the words of the late lamented Dr. Danforth, whose report is quoted in "Skin and other Diseases of India," by Drs. Fox and Farquar, "symptoms of a formidable nature set in, and all sorts of deformities occur. The nose, palate and cheeks ulcerate, the nodes terminating in caries, the globular subcutaneous tumours soften and break, the fingers and toes mortify, the hands and feet lose their sensibility, while pricking pains are often felt in them, the feet enlarged by the thickening of the tissues, and blebs of various sizes form on them and lead to obstinate ulcerations." The general health has of course ere this become deeply affected. The surface of the body acquires a peculiar clayish color and a glazy appearance, not unfrequently it is covered with dry scaly epidermis. At length the poor sufferer sinks from exhaustion, worn out by the pain and discharge, or cut off by diarrhœa or some attack of pulmonary disease. The disease attacks both the sexes of all classes and ages without distinction, but chiefly confined to the natives in certain parts of the island, though it is communicated to others by contagion. It is highly contagious and frequently communicated by co-habitation, and is also said to be transmitted hereditarily. But this latter point, however, to my mind, is not fully established, and it is apparently propagated from parents to children by contagion rather than inheriting in a manner similar to congenital syphilis. That this seems to be the case is probable from the fact that the disease seldom or never manifests itself before the children are weaned, and they are two or three years of age, and I have often observed that some children of parangi parents are attacked with it, while others quite escape it.

The presence of an initial sore in every case of the early stage that I have seen of this disease, not excepting even the young children affected with it born of parangi patients, and that it is originally an innocent sore, the result of some injury or other, as already stated, leads me to think that the disease is one propagated entirely by contagion; but at the same time, in the present state of our knowledge, I am not prepared to say that it is not communicated in other ways also. The natives are fully aware of its highly contagious nature, and, when a case occurs, it is at once isolated and kept in a separate hut, and those who have not had the disease hold no communication whatever with the affected persons. Though persons affected with parangi suffer from sequelæ frequently, I am not aware of any instance in which it occurred a second time in the eruptive form, and this is in conformity with the belief universally entertained by the natives that it affects a person only once in his life, like small-pox and some other diseases of a similar nature.

The etiology of the disease is much involved in obscurity, and I regret to say as yet no systematic and thorough investigation of it, with the aid of the microscope, has been undertaken by any member of the medical profession in Ceylon. Judging from analogy and the discoveries that have been recently made in respect to the causation of several diseases of a like nature, there is no doubt that it is caused by a virulent contagious principle of some kind similar to that of syphilis, favoured by a cachectic state of the system resulting from the use of unwholesome food and water. The disease often remains dormant after its first appearance in early life, as already stated, for an indefinite time, and is roused into activity whenever the general health falls below par, by wounds, ulcers, and occasionally by vaccination also. I have known instances of persons who had had parangi in whom vaccinia vesicles ulcerated and degenerated into open ulcers, which took some months to heal. There is no question that unwholesome food and water play an important part in keeping it up in a state of activity. This is unmistakably shown by those cases that recover under hospital treatment, and the fact of its not shewing itself before the children are weaned and begin to live independently of mother's milk. In the case of patients treated in hospital, the good effects of the treatment last only so long as they have the means of procuring wholesome food and water, and it is a very common occurrence to see relapses in patients who return to their villages after recovery, and place themselves under the influence of the same conditions under which the disease appeared in them originally.

Among the natives several varieties of parangi are spoken of, and Dr. Marshall, who was the first English writer on the disease, in his Medical Topography of Ceylon, published in 1821, mentions seven, *viz.*:—

Alu Parangi.
Ody Parangi.
Gone Parangi.
Kusta Parangi.
Dada Parangi.
Getta Parangi.
Aramana Wane Parangi.

These on close examination will be found to be rather different forms of sequelæ than different varieties of the primary disease itself, and it is doubtful whether one of them, *Alu Parangi*, has any relation to it at all. In my opinion it is a form of psoriasis confounded with parangi.

Ody Parangi is believed to be a form of the disease as existing on the Coast (India), and occasionally met with in Ceylon.

Gone Parangi is a form of the disease characterised by flattened pustules most frequently grouped in clusters, and forming thick yellowish scabs or incrustations not unlike those observed in empetigo.

Kusta Parangi is a form of skin disease, resulting from parangi, and is characterised by squamation of the skin resembling syphilitic lepra in that respect.

Dada Parangi is a form of the disease very much like ring-worm, in which the tubercles or pustules are disposed in circles.

Getta Parangi is distinguished by the presence of tumours in different parts of the body. These are gummy indolent tumours of different sizes, which remain stationary after attaining a certain size without undergoing any further changes than the presence of pain running along the nerves of the affected parts, especially if they be situated in any part of the extremities.

Aramana Wane Parangi is one of the sequelæ in which the ulcers assume a chronic form, and Dr. Marshall describes it as follows :—

"The disease occurs in all parts of the body, except perhaps the hairy scalp. The outer surface of the ulcerous surface extends, while not unfrequently the central area is healing. Occasionally the disease commits ravages on the face and forehead, the lips and cheeks being very liable to it." This description of the disease seems very much like leprosy, and it is to be feared that Marshall actually confounded cases of the latter with the former. This *Aramana Wane* has a tendency to burrow into the tissues, and is quite devoid of healthy action in any part. It is prone to bleed with the least irritation, and often resists every mode of treatment, except amputation of the limbs, which I have practised with perfect success in two instances.

Besides the varieties of parangi described above there are two other forms of sequelæ which are of common occurrence, *viz.*, *Dumas* or *Puk* characterised by the formation of rhagades or fissures round the heels and the disintegration of the plantar fascia giving a honeycomb appearance to the soles of the feet. Through the fissures on the heels fleshy excrescences protrude, and to this the term *Puk* is chiefly applied, but both the forms are attended with sub-acute inflammation, and the patients suffer much inconvenience in that it unfits them for easy locomotion on foot. These forms of the disease, supposed to be an after-effect usually of the imperfect development of the primary eruptions, are very difficult of cure and requires a long course of treatment before any beneficial result can be obtained.

The above is a general outline of the disease parangi as met with in Ceylon. The questions what it is and whether it is identical with any of the hitherto recognised diseases have not yet been satisfactorily answered by the profession there.

Dr. Loos, who furnished an interesting report of the disease to the Ceylon Government some years ago, considered it to be a form of congenital syphilis, and Dr. Danforth thought it to be the same " degenerating into leprosy." That it is not congenital syphilis I think is obvious from the single fact, apart from others, that the disease never manifests itself before the children are weaned, whilst we know in the case of the other it is never delayed a year, and generally shows itself within the first six months after birth. Dr. Kynsey, who not long ago wrote an able and interesting report on this disease, and to whom we are indebted for much of any clear knowledge we possess in respect of it, has advanced the view that the disease is identical with frambœsia or yaws met with in West Indies. Frambœsia was till lately thought a form of syphilis, but now is recognised as a disease *sui generis* and quite distinct from the latter. Not having seen cases of frambœsia myself, I am reluctant to express a definite opinion one way or the other, but judging from the accounts given of it by Drs. Imray and Bowerbank there seems to be indeed a marked resemblance of this disease to parangi, and if the latter is not identical with the former, it is at any rate a disease much akin to it. For, besides the general similarity of symptoms of the two diseases, there is a close resemblance, even in their respective sequelæ. The mother yaw or *Mamma Rian* which is described as degenerating into an intractable ulcer eating its way into the tissues and causing extreme and irreparable destruction of the parts around corresponds to the *Aramana Wane* of parangi above described. The ring-worm yaws is evidently *Dada Parangi* of the Sinhalese and the *Tubboe* is not unlike *Dumas* or *Puk* Parangi.

Treatment.—The remedies employed by the natives in the treatment of parangi are numerous, but their chief reliance, however, is upon mercury and China root *(Smilax China)*, a favourite composition among them is what is called *patpam* in Tamil, a compound of mercury, turmeric, camphor, China root and *sin cottea.* The latter is the marking nut *(Semicarpus anacardium)*, and the juice found between the laminæ is considered by the native doctors as a very valuable remedy for scrofula, syphilis and leprous affections. The chief indication in the treatment of parangi is the improvement of the general health of the patients by a generous and well-regulated diet. The remedies, though subordinate to it, are of the utmost importance in many cases, and the most useful of them are mercury, iodide of potassium, sarsaparilla and China root *(Smilax China)* given internally with ordinary dressings to the ulcers as suited to particular cases. The preparation of mercury, which I use, is the perchloride or the corrosive sublimate, and it is often given in conjunction with iodide of potassium, with which it then forms an iodide. It is not adapted to all cases, but to a limited class only, such as the early stage in early life. Iodide of potassium is our sheet-anchor in this disease, and is given in all stages of the disease with much benefit, and is a remedy *par excellence* for alleviation of the so-called "running pains." Sarsaparilla is a good vehicle for its administration, but of late I employ in its place an infusion of China root, which seems to possess very valuable therapeutical properties for the treatment of this disease. This, though termed a root, is in reality a tuber, and when fractured has a brownish white colour and contains much starchy matter. It is sold in almost all the bazaars in the island, and is said to be imported from China. It is not mentioned in the old medical books, which are in use among the Sinhalese, and consequently it is not exactly known how they come to use it in these cases. They might have learned its use from the Chinese themselves, who visited the island at different periods, or possibly they were informed of its therapeutic properties by the Portuguese, to whom its employment in syphilis is said to have been made known at Goa by some Chinese traders about A.D. 1535. China root acts as a powerful alternative, and is considered by natives as a specific against ulcers of a chronic nature, involving the bony structure as in those of parangi. Its chief therapeutic effect seems to be to lessen the undue secretion of pus and promote cicatrization. In the employment of mercury with China root, the natives do not pay the slightest regard to the idiosyncrasy of the system, and the result is that it is often given to excess, and the sufferings of many parangi patients met with are rather due to the abuse of this drug than the disease itself. In the year 1877, whilst in charge of a hospital in a district where this disease prevailed largely, 137 cases of parangi came under my observation. All of these were subjected to the treatment indicated above, with the result 134 were discharged, of whom 107 were cured, 25 relieved, 2 not relieved, and 3 died of other diseases.

FRAMBŒSIA.

BY ARTHUR POWELL,
Cachar.

In the September issue of the *Indian Medical Gazette* I drew attention to an outbreak of frambœsia in the Surma Valley. I shall to-day give a brief account of the disease, and point out the differences between it and syphilis, with which disease many authorities, including Virchow, Kaposi and Hutchinson, consider it identical.

I would first remark that, being a tropical disease, their experience of it must be small, either derived from the writings of others, or from a case or two, probably sent to them for consultation on account of its doubtful or atypical nature.

Frambœsia is a non-infectious, easily inoculable disease, characterised by a general eruption of raised, moist granulomata, occurring endemically in the West Indies, West Africa, South America and Ceylon, in which last place it is known as "paranghi."

The belief formerly held that it is confined to the Negro race can be no longer entertained, as, in addition to the Ceylon and my own cases, an odd case has now and then been recorded as occurring in a European.

The symptoms of all my cases were very similar. A papule made its appearance, usually on an old sore or scar, such as an ulcer, leech-bite, vaccine mark or itch pustule. This rapidly developes into a moist yellow fungoid tubercle or granuloma. Shortly afterwards, or possibly *pari passu* therewith, occurs a similar eruption over the skin generally. I do not think we are justified in dividing the disease clinically into "primary" and "secondary" stages, as in my cases the period elapsing between the first or inoculation yaw and the general eruption was always short, and in some cases not noticed by the patient.

These tubercles are raised above the surface, have a moist, dirty appearance, most resembling the mucous tubercles or condylomata of syphilis, but unlike them they attack with equal facility any portion of the skin. The tubercles vary in size from a short grain to a large walnut, or a number may almost coalesce, and give the appearance of a larger patch. They are covered with a moist secretion, or a thin scab, which is highly contagious. I have not noticed any great fœtor as is sometimes described. This is probably a matter of personal cleanliness, as my cases occurred in the jungly coolie, who is, on the whole, a cleanly animal, comparing favorably with Europeans of the labouring classes.

Some of the granulomata assume an annular shape with a healthy patch of skin in the centre. The more moist and vascular are of a yellowish pink color, whilst the drier patches present a seedy or warty appearance with crevices separating the papillæ.

The constitutional symptoms are, as a rule, slight. There may be a little fever at the onset, and if the disease lasts long, or be unusually severe, anæmia may supervene.

The children, as a rule, pursue their games, and the adults their occupation while the eruption exists.

Without treatment the eruption lasts from a couple of months to three years or more. One attack is said to protect the individual permanently. In one of my cases, No. 5, the eruption disappeared completely after a thorough salivation, but re-appeared six months later, lasted three or four months, and then left without further treatment.

The granuloma leaves a dark pigmented spot which fades slowly. In two of my cases there are permanent depressed scars, probably the result of vigorous local treatment with silver nitrate and sulphate of copper.

Sections of these tubercles shew them to be pathologically a true granuloma or papilloma, more vascular than a common wart, the spaces between the papillæ being filled with pus and ordinary scab material.

Treatment.—Preparations of mercury and iodine, as used in syphilis, are usually recommended, but I have found them of little use, unless pushed to free salivation.

One of my earlier cases (No. 5) had been under this treatment for some time without the slightest benefit. After an interval of three months, he appeared suffering from profuse salivation, having lost two teeth. The yaws had almost disappeared.

He produced a powder he had bought in the bazaar, which, on analysis, I found to consist of turmeric, calomel, about four grains to the dose, and some powdered leaves. As the salivation passed off, the yaws re-appeared but in diminished numbers.

Locally, I have found astringents, caustics and mercurials of little use.

Picric acid, applied locally, I have found the best treatment. I first used it in June last, having then 23 cases under treatment. I applied it in saturated solution, with a few drops nitric acid added to increase its solubility, to 22 of these cases; 18 are now quite cured; in two the granulomata are limited to the mouth and arms. Two children, who very seldom come for treatment, are but slightly improved. One case I reserved as a test, and treated him with mercury and iodine internally, blue ointment and astringents locally. He is still suffering from the disease, but improved.

That 18 out of 22 cases were cured in one to six months after the use of picric acid locally, while 22 cases treated otherwise took two to three years to cure, points to its efficacy. I am no enthusiastic believer in specifics for any disease, so that if these cures are merely *post hoc*, and not *propter hoc*, it remains for the experience of others to prove. If not a cure, I believe that, by sterilising the discharges, the epidemic has been stopped. Certainly no new case has arisen within a month of its first use. As an attack of fever has such a beneficial effect, I should like to try the effect of injecting some pyrogenic toxin if I had proper facilities.

That frambœsia is a disease *sui generis* absolutely distinct from syphilis no one who has seen an epidemic will deny.

In a population of 142 people living in six houses, or lines, I have had 45 cases, whilst not another case has arisen elsewhere; 34 of these cases were children under 16 years of age—too young to have sexual intercourse—at the age least likely to contract syphilis.

In none of them did the first yaw make its appearance on the genitals.

In none has there been any chancre, glandular enlargement or sore throat at the beginning of the disease. None had tertiary symptoms. None of these cases nor the wives of any had miscarriages. The wife of one patient, who had not been treated by mercury, was delivered of a healthy child with no taint of syphilis.

Two patients developed typical chancres and secondary syphilis while suffering from the yaws. Thus an attack of one disease does not protect against the other.

Though syphilis does occasionally " throw true," and patients inoculated from one source may develope similar rashes, yet the main characteristic of a syphilitic eruption is its polymorphdic character.

In all my 45 cases there was one, and only one, eruption, this granuloma or tubercle, except such diseases as ringworm and itch.

The inoculation spot was always a granuloma, never a chancre.

The incubation period seems longer than in syphilis, as one case (No. 33) had left the infected lives more than a month before the first yaw was observed. Another (No. 6) had a milk abscess which discharged for a fortnight. The first tubercle developed on the scar nine weeks after the abscess was opened. This would shew an incubation of seven to nine weeks.

The mucous tubercles of syphilis are generally limited to the junction of skin and mucous membrane. *Tubercular syphilide is a gumma of the true skin, and as such its discharges are believed to be innocuous. The discharge of the yaw is highly contagious, and is the only material with which the disease is inoculated.*

Those who believe yaws a form of syphilis must therefore hold that gummatous discharges are contagious.

Tubercular syphilide is a late secondary or tertiary eruption. The yaw is the first, an early and the only eruption of frambœsia.

In none of these cases have tertiary symptoms arisen though many have had no mercury or iodine ; further, many treated with these drugs in quantities which usually remove syphilitic symptoms have continued the eruption for three years.

I regret that other speakers have entitled their papers by the vernacular names, " Paranghi " and " Kwe-na." There are now definite English and Latin names for the disease, so other names are unnecessary, and as unjustifiable as it would be for me to entitle an English paper on fever or cholera, " bokhar " or " haiza."

(See next page for table of patients.)

BURMESE "KWE-NA."

BY ARTHUR H. NOLAN,

Assistant Surgeon.

Before giving an account of my observations and conclusions on the skin disease known as " Kwe-na " among Upper Burmans, which I believe I have correctly diagnosed as yaws, I shall record notes of a case I had under treatment at Gangaw in the Pakokku District shortly after my arrival in Burma in 1889. I had never before heard or read of Burmese " Kwe-na," nor had I during my service in India seen or heard of yaws there, and the possibility of yaws existing in Burma did not at the time occur to me. I considered this case either an exceptional manifestation of one of the syphilides, or a form of " Oriental sore," as the eruption appeared to correspond in some respects to the description and representations of Biskra and Crete "Boutons " by Dr. Vandyke Carter.

The peculiarities of the case however led me to record the following notes in my Diary :—

Gangaw, 17*th October* 1889.

" A Burman, aged 40 years, from Kale, has on the forehead a cone-shaped fungoid growth covered with a dirty yellowish moist scab. At some little distance it looks not unlike a rupoid excrescence. Base of growth about $1\frac{1}{4}''$ inch in diameter, length from base to apex nearly $1''$. Little pain on pressure over growth, or on removing a portion of the scab, which gives the excrescence a strawberry appearance.

" Skin immediately surrounding base is slightly darkened but not inflamed or tender, nor, on the contrary, is there want of tactile sensation.

" There is also an eruption of tubercles varying in size from a pea to a medium strawberry and generally round in shape. These are indiscriminately scattered over face, neck, trunk and extremities, but are more abundant on parts where the skin is moist and thin, as the flexor aspect of thighs and arms, neck, pudenda and lips. Some of these tubercles or *boutons* are hard and entirely painless, but most of them are moist from a scanty purulent exudation and scabbed. The moist ones only feel a little tender and the skin surrounding them is slightly reddened. Scabs generally are of dirty gray or yellow color, some are light brown from oozing of blood. They appear to possess the same anatomical characters as the large growth.

" The man is strong looking and well nourished. No history of syphilis, glands unaffected, no fever, complains of some pain in joints which are not swollen or tender. Calls the disease 'Quayna,' says it is contagious, and he is not allowed by the people to live in his village, nor is he allowed to take up his abode in other villages. No one else in his village is affected with it.

" He contracted it in the Chindwin district where people occasionally get it. Is not common."

The man was isolated in a small hut a short distance from my hospital which he attended daily for over a month. The greater number of the excres-

Serial No.	Name.	Sex.	Age.	Family.	Birthplace.	Seat of first yaw or site of inoculation.	Approximate duration of disease. Years.	Result	Remarks.	No. of House.
1	Kunti ...	F.	7	α	Cachar ...	A wound ...	2½	Cure	......	A
2	Mimi ...	M.	14	β	Do. ...	Do. ...	2-3	„	......	B
3	Mangru ...	M.	10	...	Do. ...	Leech-bite ...	2-3	„	......	B
4	Hikim ...	M.	16	α	Do. ...	Wound ...	3	„	......	A
5	Saponmanji ...	M.	40	α	Chota Nagpur	Leech-bite ...	2	...	......	A
6	Saro ...	F.	37	α	Do. ...	Scar after abscess in breast ...	2	Do.	......	A
7	Jadoo ...	M.	16	δ	Cachar ...	Wound ...	3	...	......	C
8	Gajadar ...	M.	50	β	N.-W. P. ...	Scar of abscess ...	3	...	......	B
9	Prokas ...	M.	9	γ	Cachar ..	? ...	2	Do.	......	B
10	Sohan Singh...	M.	38	ξ	N.-W. P. ...	Wound ...	2½	„	......	B
11	Paltoi ...	M.	14	γ	Cachar ...	? ...	2	...	......	B
12	Laphoi ...	F.	42	δ	Do. ...	Eczema on leg ...	1½	...	......	C
13	Dasarat ...	M.	15	θ	Do. ...	Wound ...	1½	...	......	D
14	Rana ...	M.	9	θ	Do. ...	Do. ...	2	...	......	D
15	Paulasia ...	F.	8	β	Do. ...	Round anus ...	1	Do.	......	B
16	Topasia ...	F.	11	γ	Do. ...	? ...	1	„	......	B
17	Bhagia ...	F.	5	γ	Do. ...	Recent vaccine mark ...	1½	„	......	B
18	Parbatti ...	F.	4	γ	Do. ...	? ...	1	...	Under treatment	B
19	Kalia ...	M.	11	η	Do. ...	Scar ...	1	Do.	......	E
20	Tulsi ...	F.	5	γ	Do. ...	? ...	1	„	......	B
21	Sukra ...	M.	5	η	Do. ...	Near anus	Less than 1 year.	...	Under treatment	E
22	Gangajali ...	F.	4	ξ	Do. ...	Round anus				B
23	Ramrikhia ...	F.	4	ξ	Do. ...	Sole of foot		Cure	......	B
24	Goburdhun ...	M.	11	...	Do. ...	Wound		...	Under treatment	D
25	Gangoo ...	F.	20	ε	Chota Nagpur	Scar				D
26	Bipia ...	F.	12	ε	Cachar ...	?				D
27	Bisnath ...	M.	42	...	Behar ...	Wound ...	2	Cure	Wife delivered a year ago of healthy child ...	D
28	Ramoo ...	M.	7	δ	Cachar ...	Wound ...	2	...	......	C
29	Haladar ...	M.	2	α	Do. ...	? ...	1 m.	...	......	A
30	Busa ...	M.	4	...	Do. ...	Near anus ...	3 m.	...	......	D
31	Unknown ...	F.	4?	...	Do. ...	Itch on wrist ...	?	?	......	...
32	„ ...	F.	3?	...	Do. ...	Cut on sole ...	?	?	......	...
33	Durga ...	M.	4	...	Do. ...	? ...	1 m.	...	Died of malaria...	...
34	Sukroo ...	F.	10	η	Do. ...	? ...	4 m.	Cure	......	E
35	Janki ...	M.	40	κ	N.-W. P. ...	Itch on wrist ...	2	...	Died of dysentery	X
36	Gandari ...	M.	50	λ	Do. ...	Sole of foot ...	3	...	Under treatment	Y
37	Mahona ...	M.	12	λ	Sylhet ...	Itch on wrist ...	1½	Cure	......	Y
38	Jhumka ...	M.	4	λ	Do. ...	Wound on knee	1½	„	......	Y
39	Bijuara ...	M.	6	κ	Do. ...	Wound on calf...	1	„	......	X
40	Begua ...	M.	10	κ	Do. ...	? ...	...	„	......	X
41	Megni ...	F.	30	κ	N.-W. P. ...	Pachwari on foot	2	„	......	X
42	Bhadara ...	M.	8	κ	Sylhet ...	Sore on foot ...	1	„	......	X
43	Bilasi ...	F.	9	κ	Do. ...	? ...	2	„	......	...
44	Etwara ...	M.	50	μ	N.-W.-P. ...	Leprous ulcer ...	2	„	......	Y
45	Bodua ...	M.	14	μ	Sylhet ...	? ...	1½	„	......	Y

Those marked by same Greek letter are either father, mother or child of same family.

cences gradually contracted and fell off, leaving the skin smooth and unimpaired, but marked by spots slightly darker than the surrounding skin.

The large excrescence and a few small ones had not quite disappeared when he left off attending hospital. Treatment was commenced with a purgative and a bath, during which the application of carbolic soap was not spared.

A two-grain dose of quinine was given every morning and ten grains of iodide of potassium with decoction cinchona twice a day. Carbolic oil, 1 in 40, was applied to the eruption.

Later, 2 drachms of liqr. hyd. perchlor. were added to each dose of the pot. iodide and the application of dilute citrine ointment substituted for carbolic oil. He was nearly six weeks under treatment.

2. I neither saw a case or heard again of Kwe-na until, in December 1892, I received a communication from Mr. R. C. Stevenson, Deputy Commissioner of the Yeu District, regarding the prevalence of the disease in one of the villages of the District named Htanbinzeit.

I quote the following passages from Mr. Stevenson's letter :—

" Having been aware for some time past that there was a village near Yushay called Htanbinzeit, the residents of which were looked upon as social outcastes by reason of their community being affected with a serious skin disease said to be by my informants a a kind of leprosy, I visited it the day before yesterday morning. * * The disease is called Kwe-na by the Burmans. * *

"It is said to be highly contagious, but more especially at one particular time of the year, *viz.*, the month of Wagaung (answering to the latter end of July and first half of August) when the sprouts of a kind of bamboo known as 'mhyinwa' begin to shoot.

" Contagion seems to depend on close personal contact, such as eating together out of the same dish, &c. * * It first commences by the appearance of a sore, which apparently scabs over very soon, but is followed by an eruption which in time covers the whole body.

" The first symptom is great aching of the muscles.

" Persons who suffer from it usually become very attenuated, and this of course is especially the case with those who succumb. * * *

" I believe the disease is a very rare one. I have never heard of it before ; the Burmans have a great dread of it, and if the villagers of Htanbinzeit were a colony of Thanatophidia they could not be regarded with greater repugnance by their fellow-creatures.

" I am informed that some years ago there was a village in the Piginsala portion of the Katha District in which the villagers suffered from the same disease.

" In their case however it appears to have been of a more virulent type attacking the joints and preventing the use of the limbs. * * * "

3. My temporary transfer from the District soon after receipt of the preceding communication from Mr. Stevenson, and other duties, prevented my visiting, until September 1893, the village of Htanbinzeit mentioned by him, and such other villages where, owing to enquiries previously made, I had heard of Kwe-na.

Notes on some of the cases I examined during that tour, as also a few of the number I have since seen, are given in the appendix to this paper. In parts where the disease is endemic the Burmans and their " Sei-Sayahs " (medicine men) regard it as a form of leprosy.

Following are the results of my observation and enquiries :—

Characters and symptoms of the typical disease.—I am of opinion that in few cases comparatively does the disease arise *de novo*, but that it is contracted principally by accidental inoculation, through an ordinary scratch, ulcer, or wound, with the virus from a previous case.

The inoculated wound inflames and becomes an unhealthy ulcer, the diameter of which may be ½ to 2 or 3 inches. It is circular or oval in shape and covered with a brownish scab.

It is usually shallow, except in the centre, where it dips. The purulent discharge is scanty and ichorous. The infected sore is called the " Ana-ma-gyee," pronounced " Unna-ma-jee," which means chief or primary sore.

After an incubative period of two to eight weeks or more, an eruption, which may appear on every part of the body (except on the scalp where covered by hair), is observed gradually developing with barely any pain into fungoid growths of various sizes.

When the general eruption appears the infected sore or " Ana-ma-gyee " usually heals.

The constitutional symptoms vary according to the physique of the individual, state of general health, and severity or otherwise of the attack.

They are usually, in ordinary cases, loss of appetite, slight depression, pain in limbs and sometimes fever and anæmia.

The tubercles arise from small flat red patches on the skin, often resembling the spots seen on tender skin after flea-bites.

These spots vary in size from a pin's head to a lentil, become papular, are at times itchy, but scarcely painful even when the papules are broken through into segments, and small yellow points are seen emerging which develop into "kwe-na" tubercles of various sizes.

The eruption may be described as moist, button-like tubercles, resembling granulation tissue, capped with dirty grey or yellow scabs formed of the scanty, thin, purulent exudation from them. When a scab is removed another soon forms from the discharge. If blood exudes, as it sometimes does when a tubercle is scratched, picked at, or otherwise injured, the color is imparted to the scab giving it a reddish or dark tinge,

The excrescences are usually round or oval in shape, some well raised, others flattened, and of sizes varying from that of a pea to a size which covers a patch of skin one inch or more in diameter, but the typical eruption in its early stage is about double the size of a well developed small pox pustule.

At times, after attaining the size of a pea or a little larger, the development of some of the growths cease, and they dry into hard insensible tubercles and fall off. Others fully develop, then shrivel, contract and fall off leaving the skin smooth and uninjured. Others, again, spread and flatten, and the scab becomes moister and thinner exposing the surface of the excrescence which may break down and ulcerate, or a high crust may form and ulceration go on under it.

In some cases a large single distinct excrescence appears, about one inch or more in diameter at its base, protruding more or less out of the skin and firm. It looks not unlike a roughly cone-shaped lump of putty stuck into the broken skin. Neglect causes it to ulcerate badly.

It will sometimes precede the ordinary general eruption or appear with it; often it is not seen at all.

The eruption is practically painless unless ulceration occurs.

The margins of skin immediately surrounding the tubercles are (in the ordinary eruption) dark red or brown, and the tubercles appear *set* into the skin.

The skin hewever is not at all sensitive or painful, nor, on the other hand, is there any loss of tactile sensation.

4. *Varieties.*—The skin affections and ulcerations that may appear in the disease are multiform.

The Burmese divide them into five forms, each of which I have seen and shall briefly describe:—

1st.—"*Kwe-pouk-pouk*" (sprouting "Kwe.")—This the typical eruption already described and is the most common.

2nd. — "*Kwe-pwe-zon*"* (elevated ringworm "Kwe").—The eruption has the same general characters as the preceding, but before breaking through the skin it causes more irritation and some surrounding induration and tenderness.

As it progresses, the tubercles become somewhat irregular in shape, and larger and flatter than the typical eruption. The scab or crust, which is yellow or brown in color, may become thickened, scaly and fissured. When the scab is stripped off, an excrescence resembles a large soft bleeding wort, unless ulceration has broken it down.

The central portions of large-sized patches may heal, leaving the skin healthy, with a border of flattened excrescences, thus somewhat representing ringworm.

This form may appear on any portion of the body but particularly on soft moist parts, and round the lips and anus. It is nearly as common as the first form and may appear with it.

3rd.—"*Kwe-kyet-kyi*" † (fowls' excrement Kwe)—from a supposed resemblance to fowls' excrement,—These are very small cone-shaped tubercles, hard and painless. They develope from minute pink patches and have tough gray scabs.

The surrounding skin is unaffected; attacks usually buttocks, extensor aspects of arms, legs and joints, but may appear on any part of the body and with other forms. Is uncommon.

4th.—"*Kwe-ta-phan*" * (from its supposed resemblance to a broken fig.)—A circumscribed indurated conical swelling at times very painful, is first noticed under the skin which is somewhat inflamed. The skin is eventually broken through, and an ichorous scanty exudation forms a yellow or brown elevated crust over the sore. Removal of the crust exposes a red fungous sore of an irregular circular shape. It may break down and become hollow and cup-shaped with fungoid margins and a tenacious slough in the centre. Appears chiefly on back, thighs and feet.

If it attacks the soles of the feet the thickness of the epidermis prevents the growth breaking through for some time, and this gives rise to a good deal of pain. Not usually multiple. May appear with the other forms.

5th.—"*Kwe-bon.*" (hidden or undeveloped "Kwe,")—In this form the Kwe-na eruption does not appear or properly develop. The joints, particularly those of the wrists, ankles, and fingers, become painful and swell. Nodes form, chiefly on the radii, ulnæ and tibiæ. After some time, if not treated, ulcers (not particularly sensitive) having brown crusts, break out over the joints and shafts of the bones.

The discharges from these spread, cause other ulcerations, and the patient goes down gradually in general health becoming cachectic and emaciated. If the disease still advances the ulcers spread and run into each other. Some patches heal while others become deep, filled with slough and are formidable and obstinate. The joints become contracted and ankylosed, the radii, ulnæ and tibiæ may become thickened, elongated, and curved†—from osteo-plastic ostitis probably—nodes break down, and the bones here and there (including at times the nasal and palate) become carious, the hands and feet lose sensibility, and the unfortunate sufferer, after lingering for a few years or more in this condition, dies from exhaustion, if not cut off by some other disease.

6th.—Besides the five preceding varieties I have seen another accompanying the typical form. The Burmese have no special name for it but call it one of the varieties of "Kwe-na."

The eruption consists of small prominent vesicles clustered together in patches. The patches sometimes coalesce. In a mild case they dry up and heal without ulceration, but in unfavorable cases they may become squamous and fissured and run on to extensive ulcerations resulting in contraction of joints, bone disease, &c.

5. *Seat of "Kwe-na" eruption and ulceration.*—As mentioned under "characters and symptoms" and "varieties."

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* Pronounced Kway-pwe-zone. From "Pwe" ringworm and "Zon" conical elevation or excrescence.

† Pronounced "Kway-chet-chee."

* From "Ta-phan-the," the fig fruit.

† It is from this condition the disease derives its name of "Kwe-na." From, "Kwe," curved bent, and "Ana" or "Na"—disease, sore.

6. *Appearance of skin on termination of eruption.*—Where tubercles contract and disappear without ulceration the texture of the skin usually remains smooth and uninjured. The maculæ are generally dark coloured. In cases marked by ulceration the cicatrics present the appearances common to ulcerative processes which have extended to the deep layers of the cutis and connective tissue.

7. *Prognosis of the disease.*—Favorable, as far as I can at present judge, if properly treated before the general health becomes badly affected and the ulcerations extensive. The disease varies much in severity, from a small crop of tubercles to rhagades and fissures of the skin with extensive foul ulcerations, disease of bone, &c., which render the unfortunate victims helpless cripples, until worn out by pain and discharge, exhaustion brings death.

8. *Duration.*—The usual duration of the ordinary eruption is said to be from six weeks to six months, but it may last for years with periods of quiescence.

9. *Constitutional Symptoms.*—Pain more or less in limbs, nervous depression and at times feverishness occur during the commencement of the disease.

If a good crop of the eruption appears these symptoms abate or pass off. Men and women work, and children play as usual.

When however the disease does not develope in its early stages, or has existed for some time, the patient becomes anæmic, lean, and debilitated, and liable to febrile or other climatic diseases.

10. *Contagiousness.*—It is communicated chiefly by contact and accidental inoculation. An ordinary wound, ulcer, or any affection of the skin where the cutis is broken or abraded, renders a person liable to the disease, if living in the same house or coming frequently in contact with the infected. The virus of the disease may be conveyed from an affected person to others by mosquitoes, fleas, &c.

People affected in a village are to a certain extent isolated.

11. *Hereditary.*—It is not hereditary.

12. One attack does not apparently secure immunity from a second or more.

13. The disease attacks both sexes alike and people of all ages.

14. *Relation to Syphilis or Leprosy.*—In my opinion none whatever. I have however seen two cases in which the manifestations of syphilis appeared to coexist with "Kwe-na," and believed the individuals to be infected with the virus of each disease.

15. *Treatment.*—In treatment by the "Sei-Sayahs" (native medical practitioners) crude mercury, or the red sulphuret, are the active ingredients in their prescriptions. With the mercury, they generally combine in powder, as adjuvants and correctives, nutmeg, cloves, sessamum, cassia, pulp, betel nut, betel leaf, catechu, pyrethra root and palmyra leaf.

In some cases the medicines are administered by mouth, but more often by inhalation. The epidermic method too, with mercury and fats, is sometimes employed.

The "Sayahs" say that unless the disease is treated with mercury it gradually progresses with periods of dormancy and death is inevitable.

The process of treatment by mercury—inhalation particularly—is sometimes carried out to the extent of causing most painful and destructive results from extreme salivation.

I have seen cases in which necrosis of the palate and nasal bones had occurred from the excessive administration of mercury.

I should think a few die, while others are left physically wrecked and miserable for life after such disastrously heroic measures.

I can say very little from personal knowledge as regards suitable treatment, having had but few opportunities of seeing the final results of my treatment in a small number of cases of the typical eruption, and in the ringworm variety.

I have used iodide of potassium only in some cases; in others the potassium iodide combined with perchloride of mercury, and latterly, arsenic.

Locally, carbolized vaseline, nitrate of mercury ointment, and touching the excrescences with sulphate of copper.

In three cases treated with perchloride of mercury and iodide, with the local application of cupri sulph. the tubercles disappeared, but I do not think the disease was cured. In three more cases the same internal treatment caused an increase of tubercles. Arsenic was then tried with benefit.

In one case a few doses only of 5 grains of pot. iodidi with 1/20 grains of hyd. perchloridi caused severe iodism. Arsenic was then given with benefit.

Cases in which the bones become affected and nodes form, I should treat with iodide of potassium, application of iodine, &c., as for similar conditions in syphilis.

To ulcers, I would apply iodoform or carbolized dressings.

Personal cleanliness, suitable diet and good hygienic surroundings would do much towards cure.

In the "Kwe-bon" variety, where joints swell and nodes appear, the native practitioners apply blisters over them, and minister mercury.

16. *General Remarks and Conclusions.*—We have here a disease which, if not yaws (Frambœsia), bears a very close resemblance to that peculiar skin affection in its characters, constitutional effects, nature, contagiousness, forms, terminations, and even in treatment by the natives, in so far that mercury is the active ingredient.

I recognise the identity of—

(*a*) "Kwe-pouk-pouk" with the characters of the ordinary yaw eruption;

(*b*) "Kwe-pwe-zon" with ringworm yaws;

(*c*) "Kwe-ta-phon" (and the large cone-shaped excrescence which appears occasionally) with the English "mother yaw" or "Mamman-pian" of French *patois*;

(*d*) The tough skin covered "Kwe-ta-phan" of the feet, with the "Tubboe" or crab yaw;

(*e*) "Kwe-bon" and its effects, with those sometimes resulting from undeveloped yaws ;

(*f*) "The vesicular variety," with the form of yaws called "Pian pratelle" ; and

(*g*) The deep ulcerative and destructive phase of the disease with the neglected large intractable ulcers in yaws which cause similar damage and sometimes death.

I would also mention that I consider "Kwe-na" quite as identical in its characters, &c., to yaws, as the "Parangi" disease of Ceylon, the "Pian" of Java, the "Coko" of Fiji, and the "Verrugas" of Peru, which are now recognised as yaws.

It will, I think, be difficult to trace the origin of "Kwe-na" in this country. Old Upper Burmans on the Yeu District say it has always existed in parts of Upper Burma. Some Lower Burmans aver they have not seen or heard of the disease in Lower Burma, and Mr. Robert C. Stevenson, who has spent over twenty years in Burma, and has an exceptional knowledge of the country and customs, habits and language of its people, informs me that he had never heard of "Kwe-na" before learning of its existence in Htanbinzeit Village. It may be an endemic indigenous cachexia, consequent on vitiated nutrition from bad hygienic surroundings, exposure and potent malarial influences, and its spread caused by contact and accidental inoculation ; or, if its origin by importation be presumed, it must have occurred so long ago that the hope of gaining any definite information on this point from enquiry is very problematical. I see no reference to it in one of the latest works on skin diseases, nor do I remember ever seeing it mentioned in medical periodicals. The Burmese are a conservative and reticent people as regards disease and suffering among themselves, particularly if the disease be of a contagious or infectious nature, and I think very few, if any, have sought treatment for "Kwe-na" in any of the dispensaries in districts, where, as far as I present know, the disease *is endemic during the early rains.* These are the Districts—Yeu, Shwebo, Katha, Upper and Lower Chindwin.

PSILOSIS OR SPRUE.

BY JAS. MOORHEAD, M.D.,
Surgeon-Major, I. M. S.

Psilosis or sprue is a disease so seldom met with in India, or elsewhere, that I hope a short account of a case I have recently seen, and had for a few weeks under observation, may be of general interest. The term psilosis, which is borrowed from the Greek and means bareness, has special reference to the condition of the tongue, the throat and intestinal mucous membranes. This term was first, I believe, given to the disease by Dr. Thin, who published a paper on the subject in the *Practitioner* some years ago. Sprue is the name given to the same affection by the Dutch physicians. The disease has also been called diarrhœa alba, white flux and cachectic diarrhœa, and has been seen in China and in Java as well as in India. It appears to be confined chiefly to Europeans.

Psilosis I should define as a chronic wasting disease, characterized by soreness and rawness of the mouth and throat by the passage of frothy, loose, colourless, pungent stools and by atrophy, more or less general, but specially of the liver and intestines.

Mr. L. S. is a man of 42 years of age, about six feet in height, of temperate and active habits, who first arrived in India in November 1876. He had served over seven years in the navy before coming to this country, and was in good health when he retired. He had a mild attack of dysentery in England in 1875, and had a similar attack in India in 1887. In 1878 he suffered from ulcerated sore throat at Hardui, and at the same place he had a mild attack of typhoid fever in 1880. In 1883 he was transferred to the Kumaon Division, and up to the beginning of 1890 he continued to live in the Kumaon Hills with his headquarters at Naini Tal. For those seven years he led a most active life, being constantly in the saddle or making long marches on foot ; he was often subjected to frequent and sudden changes of temperature and barometric pressure—to-day performing his duties at an elevation of 1,000 feet, to-morrow at an elevation of 7,000 feet above sea level ; he was often obliged to be content with food indifferent and badly cooked, and his meals were often taken at irregular times. In 1883 he had occasional short attacks of dyspepsia with heartburn and diarrhœa, but he does not remember whether he had at the same time soreness of the mouth. From 1884 to 1886 he kept generally healthy. In 1887, while at Naini Tal, he had an attack of sore mouth and throat lasting for ten days. In the spring of 1889 he had a severe attack of vomiting and diarrhœa, and during that attack he noticed for the first time that his stools were frothy, acrid and colourless. The stools during that attack were sometimes passed involuntarily and were as many as thirty in a day. He does not remember that his mouth was sore also, but he has suffered from this condition so long that only very aggravated attacks remain in his recollection. Since that attack in 1889 he has hardly ever passed a healthy motion, his stools having been almost always colourless, even when there was an approach towards, if not actual constipation which very rarely happened. He had a severe attack of sore mouth towards the end of the year 1889, and says he felt very ill. He does not remember about the condition of the throat. In February 1890, while at Allahabad, he had another attack of sore mouth with vomiting, griping, and diarrhœa of the usual sprue character. His illness continued also in March and in April ; he was sent for a change to Naini Tal. There he improved and he was able to resume work on the 14th of May. From June 1890 up to June 1891 he has no distinct recollection, but remembers there was no change in the character of his motions, and that there was a general downward tendency in his health, which necessitated his taking six months leave to England. He had an attack of sore mouth and throat on the voyage home, and nearly the whole time he was in England he suffered from indigestion, depression of spirits and general debility. Still in bad health he returned to India. On the voyage out he picked up considerably, but almost immediately after his arrival at Bombay he had another severe attack of acute sprue which continued for some time afterwards at Allahabad. In 1892 he had three similar attacks, one of which he believes was due to worry from loss of money. One of those attacks lasted for three weeks. In July 1893 he was obliged to have ten days' leave for a change owing to sprue, and in October he had a very aggravated attack of sore mouth, accompanied by the passage of stools of a somewhat dysenteric character. In May last he caught a chill at a pic-nic and suffered in consequence from severe colic with diarrhœa and vomiting. In July he thought himself well enough to play racquets, but in August and September he had an aggravation of his disease, his stools becoming again more or less dysenteric. In October he came to Simla and was almost daily under my observation from the 9th till he left on the 29th.

I shall now endeavour to describe to you his condition as I saw it :—

His appearance was that of a man in chronic ill-health ; he looked thin, weak, somewhat anæmic, careworn, withered and haggard, but at the same time his general condition was considerably better than the history of his case would lead one to expect. His weight was about 10½ stones or perhaps a little less, which is a stone or more under his weight previous to his illness

His tongue looked abnormally clean, red and glossy, and as if denuded of its epithelium ; it was somewhat dry and glazed towards the centre ; its edges were moist with projecting papillæ, and presented transverse and longitudinal furrows but no fissures. It was on two or three days partially coated with a mouldy film and the same condition was present on the front of uvula and back of pharynx. At an earlier period he told me there was a distinct movable membrane of fur on the back of the tongue and soft palate. There was no ulceration. The gums were pale and tender, but neither spongy nor ulcerated. The soft palate was somewhat injected. His throat was somewhat red and tender but not ulcerated. There was no salivation during the day, but there was often dribbling during sleep, though the tongue and back of the palate felt dry and parched at night. Soreness and tenderness of the mouth and throat were constantly present, but there was no aggravation of these symptoms while he was under my observation. Swallowing was always somewhat painful and difficult even for the blandest of food, and he told me that sherry would sting or burn him acutely. His taste, he thought, had become blunted generally, but he believed it was still very keen for tea. His smell was not affected. His appetite was variable, sometimes being considerable, if not ravenous, but generally below par. He had twice during this year a great craving for sugar, in the form of sweets, and has generally a craving for fruits, especially cooked fruits. Vegetables he cannot tolerate, but beer he says in the intervals of acute attacks agrees well. Pomfrets he says have always upset him and spirits he always avoids. He suffers frequently from dyspeptic symptoms in the form of acid, acrid eructations with flatulence and sometimes pain. He has never suffered from a feeling of emptiness in the stomach such as has been described, and there was no tenderness or pressure over it. His stools varied somewhat in character and much in frequency during the three weeks of his stay in Simla, but in both respects there was a decided improvement the last few days before he left ; sometimes there were as many as seven or eight motions in twenty-four hours, and for a few days mucus and traces of blood were present. The stools varied in consistency from pultaceous to liquid, and were generally, if not always, accompanied by much wind and often by a feeling of pain in the lower part of the bowel and burning in the arms. They were most frequent in the evening and during the nights. They were always acrid, sometimes frothy, and generally colourless and not very offensive ; slight yellowness was noticed sometimes towards the end of his stay. The motions were always prolonged, one taking as long as fifty minutes. The average duration was quite twenty minutes. Twice the motions were passed during sleep and the same has occurred four or five times previously. He has noticed that these involuntary motions were not offensive in smell and that the soiled clothes were easily cleaned. He has always to make a bolt for the bath-room, and if he cannot get there promptly, he soils his clothes. At first, as a rule, only some mucus comes away with much wind, and he has to wait about fifteen minutes before any feculent matter is passed. There is more or less griping.

His liver was considerably atrophied, being only about two-thirds its normal size ; in the nipple line the dulness extended only from the upper border of the 8th rib to the lower margin of the 6th, and in the axillary line from the lower border of the 7th to the 10th rib, it did not extend to the left of the median line. It does not appear to have undergone any appreciable change since January 1893, when he was told it was about two-thirds the size it should be. There was no general jaundice, but there was slight yellowness of the conjunctivæ such as is common in people who have lived long in India. During the past autumn he suffered from almost constant but not severe pain between the scapulæ. His *urine* was of the normal colour, except on one or two days when it was turbid and somewhat high coloured from urates ; it varied in specific gravity from 1,010 to 1,020 and was free from albumen and sugar.

Depression of spirit was present in a considerable degree for several days, but he was quite bright and cheerful when he left and he has written me twice hopefully since. He is naturally a man of good intelligence, of fine social qualities, and high spirits. He knows a good deal about the nature of his disease, quite as much perhaps if not more than many physicians. Since his illness commenced his capacity for work, both mental and physical, even when feeling tolerably well, has very considerably diminished, and the concentration of his mind upon any subject for any length of time is very difficult if not impossible. In spite, however, of all this he has managed to stick to his duty and to do a fair amount of work, and he hopes to complete his service for pension in a few months more.

The *pathology* and *etiology* of psilosis are not definitely known. It has been ascribed to malaria, but this view does not seem applicable to my case, as Mr. L. S. has never suffered from any kind of malarious fever, and has neither enlargement of the spleen nor blueness of the gums. Dr. Vanderburg of Batavia in Java, who appears to have studied the disease very closely, tells us that psilosis is, as a rule, a disease of middle life, that it attacks women oftener than men, that pregnancy predisposes to it, and that it is less frequent amongst dark races than white. He considers the disease is always protopathic, or in other words that it never appears in consequence of other disease. Dr. Beggs of Hankow believe the disease is due to bacilli, and he tells us Dr. Wethered of London, physician I think to the Brompton Hospital, concurs in that opinion. Dr. Wethered has found micro-organisms present in the stools in large numbers, and the peculiar white coating which sometimes lines a portion of the bowel consists according to him almost entirely of bacilli. Post-mortem examination have revealed great thinning of all the coats of the small intestines with more or less atrophy of the different glands; granular and fatty degeneration are generally present and may be accompanied by amyloid infiltration. The liver has been found flaccid, anæmic and small, but Goodeve tells us it may be of natural size and without any decided morbid appearance.

The treatment of psilosis varies in the different stages and according to the severity of the attacks. When the symptoms are severe, rest in bed should be strictly enforced and a milk diet ordered. The milk may with advantage be diluted with lime or barley water, and the addition occasionally of linseed tea will be found both palatable and soothing. Not more than a small tumblerful of milk should be given at a time, but it may be given every two hours while awake. If the milk given in this way is found to disagree, peptonized milk may be tried, or the milk may be combined with some of the well known peptonized food such as Benger's. If the milk diet causes disgust, or if the milk disagrees, a change must be made, and soup thickened with arrowroot or Floridor ordered. When the urgent symptoms have subsided, and the patient's condition appears to permit of it, a return to solid food may be gradually made. Fish is probably the safest thing to begin with. It is of the utmost importance to avoid chills; the bath-room should be artificially warmed when the weather is at all cold, and the patient should be warmly wrapped up when he leaves his bed. The importance of having the bath-room heated was very well illustrated in the case of my patient. One night his bearer omitted to charge the stove with oil, and the result was the patient had four, what he called, violent motions from 10-15 A.M. to 4-30 A.M.

As regards drugs, opinions vary: some seem to think them useless, but this appears to me to be a very extreme view. For my patient at the outset I prescribed pepsin with euonymin and iridin in quarter-grain doses, and hydrarg. cum creta in half-grain doses subsequently; when dysenteric symptoms supervene I gave ipecac. Some emetine with bismuth and soda, later on when those symptoms disappeared, bismuth and pepsin with pulv. rhei in two-grain doses thrice daily, shortly before food. I also employed, and I believe with considerable advantage, morphine suppositories for several nights, at first in quarter-grain strength and afterwards in the pharmacopœia strength. Dr. Beggs of Hankow speaks very highly of yellow santonine given in five-grain doses daily with a teaspoonful of salad oil. He has had, he says, excellent results himself, and others have confirmed the efficacy of the treatment he recommends. He lays great stress on the use of yellow, not white, santonine. I have recommended my patient to give it a trial.

Those wishing to read up the subject of my paper I would refer to Dr. Goodeve's article on "White Flux" in Reynold's System of Medicine, to Chevers' work on the "Diseases of India," to Sir Joseph Fayrer's Lettsonican Lectures, to Dr. Thin's article in the *Practitioner*, Vol. XXXIX, No. 5, to Dr. Begg's paper in the *Edinburgh Medical Journal* for September 1890, and to his communication in the "Medical Reports" of the Imperial Maritime Customs, China, just recently published. A brief but good account of the disease appears in the Medical Annual for 1889.

THE IMPORTANCE OF RESPIRATORY AFFECTIONS IN THE MORTALITY OF NORTHERN INDIA.

BY THOMAS HOLBEIN HENDLEY, C.I.E.,
Brigade-Surgeon-Lieut.-Colonel, I. M. S.

As I have no doubt that many papers will be read at the Congress on rare diseases or on those peculiar to the tropics, I should like to draw attention to the even more urgent necessity of carefully studying the common affections which are responsible for the deaths of large numbers of people, and especially to the inadequacy of our health statistics to show what are the real causes of mortality in India, and particularly in the Northern Provinces. In the general returns, which are published by authority, no deaths are attributed to respiratory affections, whereas the death-rate from fevers is stated to be enormous. No doubt it is, but I believe that, in a large number of cases, the predisposing, if not in many instances the true cause of death, is some disease of the lung, which is generally either pneumonia or pleurisy.

My principal reason for coming to this conclusion is that in the *post mortem* room in Jeypore in a very large number of bodies old and extensive pleuritic adhesions of one or both lungs are found, and persons who are supposed to have died from malarial fevers are discovered to have really suffered from pneumonia or pleuro-pneumonia. Between January 1888 and August 1894, 336 bodies were examined at the Mayo Hospital in Jeypore, and out of these in 129 cases one or both lungs were adherent to the chest wall, or showed the characteristic appearances of pneumonia of one or both lungs. Nearly all the bodies were those of suspicious cases, or of poor persons, which had been found by the police, or of individuals who had been admitted to the hospital when in a *moribund* condition.

In 102 cases of death by drowning there were considerable pleuritic adhesions in 18. In many of the 129 cases referred to, that is, in nearly 38·4 per cent of the whole number of bodies examined, the signs of old lung-disease were very marked. In the eleven year period, 1882—1892,* 10,202 persons were treated in the Mayo Hospital in the in and out-patient departments for diseases of the respiratory system. The total mortality, all in the in-patient wards, was 182 or 1·78 per cent., and nearly all the deaths were due to pneumonia. Out of 935 cases of pneumonia there were 93 deaths or 9·94 per cent., which may be taken, I think, to be a very small mortality, as nearly all the cases, almost indeed without exception, were of an asthenic type, and, as a rule, fatal within a short period of admission before the effects of good diet, care, and medical treatment could declare themselves.

It is extremely rare for us to see a case in which the sputum is rusty, nor is the cough very troublesome, though there may be pain in the chest. The expectoration is generally of a dusty brown appearance, and is not very profuse. The tongue is nearly always dry and brown in a bad case, and often delirium, or a kind of stupor, sets in, with, as a rule, in fatal cases, paralysis of the sphincters and diarrhœa, sometimes accompanied by swelling of the feet and albuminuria. In some cases there is gangrene of the lung, and in fatal cases grey hepatization or suppuration of the lungs are observed. The pulse is nearly always very feeble and often irregular; the temperature is rarely very high. If it is, I generally consider it as showing a malarious tendency, and give with success several five or ten grain doses of quinine.

The treatment recommended is a purge for the initial constipation; good and nourishing light diet (milk or soup) at regular intervals, especially during the night; warmth; stimulants; ammonium carbonate grs. v with decoction of cinchona one ounce, every 4 to 6 hours, and rum, if necessary; poultices are not essential; antipyrin for high temperature is but rarely used on account of its depressing action.

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* I am adopting this period in my investigations on account of the sunspot-cycle theory.

Many patients are weakly pilgrims, who catch chills from the open windows of the third class railway compartments in Rajputana from night travelling.

If a man comes into hospital at an early stage the tendency is, under these simple measures, always towards recovery, although the majority of the applicants are extremely feeble and underfed. The worst cases in these respects are those of pilgrims who fall ill on their way to their homes from distant shrines. I think the exposure at night in the third class railway carriages in Rajputana is also a cause, not only of cases of lung inflammation, but also of other disorders.

There are only wooden sunshade windows. I think glazed windows should be provided in a certain number of the railway carriages, if not in all. They might be removed in summer.

The people do not apply at the dispensaries if they are suffering from slight coughs or a little fever, and yet out of 1,307,481 new cases that were treated at nine dispensaries in the Jeypore State from 1875 to 1892, and in eight from 1884 to 1892, no less than 75,453 or 57·7 per mille of all the patients suffered from respiratory affections, whereas the figures for malarial fevers were 181,175 and 138·51, respectively, or less than two and a half times as many.

These figures show the existence of a great amount of lung-disease which, I find, is most prevalent in Jeypore in the following order of months: March, December, April, November, February and October, and least in June, July, September, August, May and January.

I find that in 1892, 106·77 per mille of all the patients who were treated in the Rajputana Jails were entered under the heads "Lung Diseases" and "Other diseases of the Respiratory System."

In the eleven year cycle, 1882—1892, there were in the same jails 5,275 cases of respiratory affections, excluding phthisis, in 62,759 total sick or at the rate of 84·05 per mille.

Here possibly the factor of overcrowding may come in, but these statistics show a large amount of lung disease, and support me in the view that, if possible, a separate entry should be made in all Indian Vital Statistics for respiratory affections.

In conclusion, I would point out the importance of not neglecting colds, especially when accompanied by pain in the chest. The distribution of pamphlets among the peoples, containing simple instructions for the treatment of early pulmonary affections, might save many lives.

ON INFECTIOUS PNEUMONIA.

BY A. DUNCAN, M.D., F.R.C.S.,
Surgeon-Major, I. M. S.

In this paper I propose to consider briefly the nature of an epidemic of pneumonia which came under my observation, and which afforded a striking example of the specific infectious nature of the malady. In my student days, the idea of pneumonia being a specific fever with its local manifestation in the lung was not advocated. Since that time, however, much evidence has been brought forward that such is its nature. The first indications pointing in this direction arose from the discovery of a bacillus. Undoubtedly the savant who first discovered this was the late Dr. Friedlander. In 1877 I was working in the laboratory of Professor Recklinghausen, to whom Dr. Friedlander was Chief Assistant, and I remember in conversation with him his telling me that he was on the track of a bacillus. I do not propose to enter into the subsequent researches on the micro-organism beyond merely recalling some of the names, such as Wechselbaun, Fraenkel, Talamon and many others who have worked at this subject. The bacillus of Fraenkel is however claimed at the present day to be the essential micro-organism.

I pass on now to the history of the epidemic I noted. On November 25th, 1885, the 23rd Pioneers arrived at Umballa from the Pishin Valley. From November 25th, 1885, to April 26th, 1886, thirty-three cases of pneumonia occurred. By months they were thus distributed: four in November, nine in December, five in January, five in February, five in March, five in April. Many surmises as to the cause of the affection were held. *First*, that the regiment was inadequately clothed, and that the men caught cold. Now the regiment was in fact one of the best clothed in the Native Army. In addition to their ordinary dress, each man had been provided with a thick sailor's jersey. *Secondly*, it was held that the regiment had returned from Pishin broken down in health. The following was the daily admission rate for the regiment from 1881 to 1886: In 1881, 39·65 per 1,000; in 1882, 37·29 per 1,000; in 1883, 22·53 per 1,000; in 1884, 18·55 per 1,000; in 1885, 31·41 per 1,000; in 1886, 19·62 per 1,000. At first sight the admission rate for 1885 seems greatly in excess of that for 1883 and 1884, but a more minute examination shewed the following facts: The great bulk of the regiment was in the Hurnai Pass up to April 18th. From April 18th to November 16th the regiment was in the Pishin Valley. From the latter date it travelled to Umballa, reaching this place on November 26th. Now the rate of the head-quarters admission from January 1st to April 18th was 25·74; from April 18th to November 26th, 19 21; from November 27th to December 31st, 39·40. Hence the large bulk of admission occurred after the regiment had returned from Pishin, whilst in Pishin the admissions were only slightly in advance of those of the preceding year. *Thirdly*, a white fog that prevailed in the lines in January was held in some way to have caused the disease, much in the same way as a yellow fog was evoked to account for the cholera by some authorities in Egypt in 1883. Unfortunately, however, for this foggy idea, the pneumonia continued when the white fog had disappeared, much in the same way as cholera has appeared when there has been no yellow fog. *Fourthly*, it might have been due to the cold from December to February. Cold, however, could not have caused the cases later. The temperature was taken in my hospital three times daily. Not to weary you with the tables I will merely state the temperature found at noon. In March it ranged from 71° to 80°. In April from 75° to 94°.

As cases still continued to come into hospital, I determined to treat them as infectious. Under my advice the O. C. had the lines evacuated and the men placed under canvass. The lines were then disinfected with sulphurous acid gas for six hours, every aperture being closed up, and on the day following the fumigation they were freely ventilated. On the third day the lines were re-occupied. By April 14th, all the lines, with the exception of those of the band, had been disinfected. On April 14th, case thirty-one, that of a musician, occurred. On the 15th the band went into tents. Two cases subsequently occurred on April 18th in the married lines: one on April 26th in the band lines. Both these cases occurred nine days after the lines were re-occupied, or eleven days after they had been evacuated for disinfection. But if pneumonia be a specific infectious fever, it will have a period of incubation. This period it may be not too much to assume may be as long as eleven days, and thus the disease may have been caught before the lines were disinfected. This theory receives support from the fact that during the same months measles had been present in the married lines. Now, subsequent to the disinfection, three cases of measles occurred, two on April 17th in lines disinfected on the 13th, and the third within a week from the disinfection. The incubation period of measles is stated to range from 7 to 21 days. Hence it is probable that all these cases were beginning as regards incubation before the lines were disinfected.

After case 33 the epidemic ceased.

I now propose to offer some observations on this epidemic, and to put forward the reasons for considering it to have been not a merely local inflammation of the lung:—

1. *Date of Appearance of the Physical Signs.*—There would probably have been some uniformity in the date of appearance of the physical signs had it been only a simple inflammation of the lung. The physical sign surely should appear on the first day if the fever had so resulted. But—

In 23 cases they appeared in 5 cases on the 2nd day.
in 7 cases on the 3rd day.
in 3 cases on the 4th day.
in 4 cases on the 5th day.
in 1 case on the 6th day.
In 3 cases the date was not noted.

2. *Different conditions of the lung present on the return to the normal temperature.*—If the pneumonia had been a simple local inflammation then with the return to the normal temperature the local condition of the lung should have been generally more or less identical. But in twenty-two cases in which the condition was accurately noted when the temperature fell to the normal—

In 3 cases it was in the 1st and 2nd stages.
In 1 case in the 1st, 2nd and 3rd stages.
In 3 cases in the 2nd stage.
In 10 cases in the 2nd and 3rd stages.
In 5 cases in the 3rd stage.

3. *If the affection had been merely a local one, then on the return to the normal temperature the lung should quickly be found to have cleared up.*—But—

In one case nine days after the return to the normal temperature, the first and second stages were found to be present.

In six cases, the signs of the second stage were present, three, four, seven, eight and fourteen days after the return to the normal.

In one case, those of the second and third stages were found eleven days after the return.

In ten cases, signs of the third stage were found on the second, third, fifth, sixth, sixth, sixth, seventh, twelfth, sixteenth and nineteenth days. If, however, we consider the lung affection merely as local expression of a specific fever, then there is no necessity for it to have ceased at the return to the normal. Thus Peyer's patches are not normal in enteric when the temperature become so.

4. *There were cases of exceedingly high temperature with no corresponding extent of lung affection.*—Thus in one case only the lower lobe was affected, yet the temperature reached 106·4.° In another where only one lobe was affected the temperature reached 106·8.°

5. *In cases where the second lung became affected secondarily to the first had there been merely local inflammation, then a second rise of temperature should have taken place.* But cases occurred where, although the temperature had fallen to normal, it remained so notwithstanding the second lung became subsequently inflamed, or where a rapid fall of temperature occurred coincidently with the onset of inflammation in the second lung.

Such then are a few of the arguments that concur in supporting the idea that this epidemic was one of a specific fever, having the inflammation of the lung merely a local phenomena.

Pneumonia has frequently occurred in epidemics in the North-Western Frontier. The idea that cold especially predisposes to pneumonia was conclusively proved to be erroneous by Dr. Sanders of America. In a paper published in the American *Journal of Medical Science* for July 1882 he shewed the disease to be more frequently met with and more common in warm than in cold climates, and in hot than warm climates, shewing a gradually increasing ratio from the Poles to the Equator. That pneumonia, other things being equal, increases uniformly in frequency the nearer we approach the tropics. Other relations with the tropics are found to exist, *e.g.*, a higher death-rate. Statistics for warm climates shew an average 1·70 death per 1,000, whilst for temperate zone the ratio is 1·31 per 1,000. These facts fully dispose of the old notion of pneumonia being a local affection due to cold. With these few brief remarks I bring this history to a close.

HICCOUGH.

BY ERNEST ROBERTS, M.B., M.R.C.S.,

Surgeon-Captain, I. M. S.

I WAS led to the consideration of hiccough by some strange experiences in my jail hospital little more than two years ago. I entered into that heritage of woe in April 1892, at the time when an epidemic of influenza was wearing to its close, and for the first three or four months I had little or no trouble with the health of the prisoners, but in August and September I had a most anxious time with a large number of cases of obstinate remittent fever and dysentery. Fully sixteen per cent. of the convicts were on the sick list, and the majority were suffering from anomalous remittent fever.

I had the men well under observation, for most of my time was spent in hospital, and I was struck by the fact that several of the worst cases of remittent fever were attended by attacks of hiccough—attacks which alarmed me by their persistence, and by the evident exhaustion they induced, so much so, that my rather callous and unobservant assistants came to attach a very grave prognosis to the symptom. Two of these cases ended fatally, and I may say here that *post-mortem* examination gave the accustomed picture of death after remittent fever, besides great engorgement of the lungs. There was clot in the right heart and in the pulmonary artery; nothing abnormal about the stomach or its contents. One case that did not so end particularly impressed us.

An apparently healthy convict of more than average physique was employed as a sick-nurse in hospital. At lock-up he went off duty, ate his evening meal, and was marched to a different barrack, making no complaint of feeling ill. Some three or four hours later, when all was still, he rose from his bunk and walked down his barrack to the urinal, when suddenly he gave a cry, reeled and fell down and was found to be quite unconscious by the Lumbardars, who reported the occurrence and had the man transported to hospital. I saw him at 11 P.M., and found him unconscious, somewhat livid, with a quick bounding pulse, a temperature of 103° quick, somewhat stertorous breathing and most alarming hiccough. We managed to empty his stomach by an emetic and his bowels with an enema. He was blistered over the epigastrium, and the back of his thorax was counter-irritated with mustard, and I may say at once, without further detail, that two days later he left hospital to complete his convalescence in a less crowded barrack. The idea of ptomaine poisoning in this and other cases struck me, and I looked for light and leading among the authorities, but the oracles were dumb or mumbled incoherently. Files of medical journals also, when I got access to them, only taught me that others had been puzzled by this symptomatic spasm, and as is nearly always the case, where pathology is weakest, therapeutic fancy flourishes amazingly, and nearly every drug in the Pharmacopœia (not to mention all kinds of gymnastic postures) has served as a weapon in the hands of the kindly souls, who respond to the queries in the "hard cases" at the tail ends of the papers. It often seemed to be a case of trying one or more of the mysterious and obscure drugs that no one ever uses, but which are like the "fly in amber," and which seem to maintain their places through successive editions of the Pharmacopœia, in spite of the law of natural selection.

Among the most amusing and instructive hints I got, I found in Plato's "Banquet." I was recruiting my wasted energies in a boat on the Ganges at Narora, with Scott's pocket volume in my hand, and if you will bear with me for a moment, I will read you what the sage Eryximachus propounds :—

Aristodemus told me it came next in turn to Aristophanes to speak, but whether from repletion, or whatever else was the cause, he happened to be seized with a fit of the hiccoughs, and consequently became unfit for speech-making, upon which, as he sat next to Eryximachus, the physician, he addressed him thus: "Eryximachus," says he, "it is only fair that you should either cure my hiccoughs or speak in my turn till they have left me." To which Eryximachus replied, "Well, I will do both. I will speak in your turn, and you, when your hiccoughs are gone, shall speak in mine, and while I am speaking, if you will hold your breath for a considerable time, your hiccoughs will perhaps have an end. Should they continue, notwithstanding, then gargle your throat with water; but if they are very obstinate, take some such thing as this feather, and tickle your nose till you provoke a sneezing. When you have sneezed once or twice, your hiccoughs will cease, be they ever so violent. As soon as you begin your speech," says Aristophanes, "I shall set about doing what you bid me." And I may say that the result fully sustained the physician's reputation.

I hope to show the rationale of these successful suggestions in the course of some necessary recapitulation of the physiology of respiration, for we have to do with an inspiratory spasm of the diaphragm which is *facile princeps*, the motor organ of respiration; and it is a point of importance to note that in all cases of severe hiccough complicating an impaired function of the respiratory apparatus, and in most cases attendant on derangement of the stomach and intestines, the muscles of extraordinary respiration act simultaneously with the diaphragm.

First we may note that, although the first trace of a muscular partition between thorax and abdomen is met with in Urodeles, and that these indications are much plainer in crocodiles and birds, yet the complete diaphragmatic division does not exist in the scale of animal life below the mammals. Next, as regards the idiosyncrasy of the action of this muscle, in normal breathing, it may be said to stand by itself, in that being functionally an involuntary muscle, it is directly under control of the will. In normal breathing it undergoes a sort of tetanic contraction (not what physiologists call a "simple muscular contraction"), while in hiccough, which we regard as a derangement, there occurs really a simple single contraction, such as is elsewhere the rule in voluntary muscle. (Landois and Stirling.) I must now briefly draw your attention to the chief nervous connections of the (double) respiratory centre.

The Vagus, Supr. Laryngeal and Fifth are the afferent N. N. in most intimate relation with the respiratory acts, and the Glossopharyngeal N. is an inhibitory N. of breathing, which comes into play in this direction at the commencement of deglutition, and we may now see the *modus operandi* of the drinking, sneezing and gargling "cures." "And so it is also of good signality, according to that of Hippokrates, that sneezing cureth the hicket," Browne, "Vulgar Errors." I would also remind you of what Burton says in his "Anatomy of Melancholy" (p 549): "He shall be a Knight, a Baron, or by some false accusation, as they do to such as have the hickop, to make them forget it." This illustrates the "minus" influence of the higher cortical centres.

It is to be noted that Marckwald found that by modifying the intensity of shocks to sensory nerves, we could call forth reflexly an inspiration or an expiration independently, and that the inspiratory centre was dominant and far more easily called into play than the expiratory. Foster confirms this and gives an instructive experiment on a rabbit. If the lungs are inflated repeatedly without any attempt to draw out the air after each inflation (what is called "positive ventilation"), the result is that inspiratory efforts are diminished, and, if ventilation continues, they may cease altogether. If, however, air is repeatedly sucked out of the lungs without any countervailing inflation ("negative ventilation"), the inspiratory efforts increase, and may be such as to bring the diaphragm to a state of tetanic spasm. In the same way collapse of the lung developes inspiratory efforts, the vagus being the instrument of communication with the respiratory centre. Again as regards blood changes in the lungs—

1. Anything which diminishes the circulation in the medulla oblongata (failing heart),
2. Warming of the blood above normal (fevers),
3. Venosity, imperfect aeration (failing heart and lungs)—

all tend to induce inspiratory efforts in excess, and while the centre is affected by venous blood it (the centre) is, until exhaustion set in, more irritable and more easily and largely affected by afferent impulses than its normal condition. During dyspnœa, a stimulus, which, if applied to the vagus or other sensory nerve under normal conditions, would produce little or no effect, may start very powerful inspiratory movements. (Refer to Cheyne-Stokes' Respiration).

4. Finally, conditions of the blood other than variations of the amounts of O and CO^2 may materially affect the the working of the respiratory centre. The "breathlessness" caused by muscular exertion is not solely, nor chiefly, due to the venosity of blood caused by changes in active muscle. (Foster and Lagrange). The latter brings strong evidence to bear in favour of an auto-toxication (breathless ness and painful stiffness of muscles are common to fevers and to unaccustomed exercises); the combustion of muscular work (and the muscles are more than organs of locomotions, they are "glands ') produces products of dissimilation, which alike destroy the quality of irritability of a muscle, and produce a kind of systemic poisoning. If we inject into the muscles of a healthy frog a solution made from finely powdered fatigued muscle, the frog's muscles lose their irritability and refuse to contract. Alike in fevers and unaccustomed exercise we have a condition of uricacidæmia, which has certain striking analogies to an attack of lithæmia, and I would refer to Gautier's work on the products of muscular dissimilation (*Acad. de Med.*, January 15th, 1886), which he classes as toxic alkaloids under the name of "Leucomaines." An interesting practical demonstration of the foregoing statements is open to each one of us who cares to study the phenomena of "breathlessness" from running. The normal respiratory rhythm is quite altered from 10 to 12 to about 13 to 5; inspiration is prolonged, expiration is shortened. The lungs are face to face with a double task, the necessity of eliminating CO^2 and other products of muscular action, and they also have to cope with increasing vascular engorgement due to rapid heart-action, and this, as we shall see, is met by the partial vacuum, or negative pressure caused by inspiration. In the most advanced stages of breathlessness, "dyspnœa," we see no longer quickened respiration, but imperfect, half-finished respiration, interrupted by stoppages, inspiratory efforts, hiccough, and finally total arrest of movement.

My point so far has been to present a clear picture of the respiratory mechanism and its complicated reflex connections, and to remind you of the chief pathological conditions which react specifically upon the respiratory centre. Any one that looks into the literature of hiccough, consisting as it does almost entirely of clinical notes recording the occurrence of this spasm in the course of other derangements, will see that it is associated with—

1. Fevers, specific or symptomatic,
2. Pneumonic congestions or consolidations,
3. Gastric or intestinal derangements, including "gout" (included in above are toxæmic states, uræmia, ptomainæmia),
4. Hysteric hiccough, which nearly always arises in conjunction with some dyspepsia and the anæmia, which involves deficient oxygenation, and puts this class into 2,3 supra.

But after what has gone before, I shall be understood if I say, that, given a case of hiccough, we shall be justified, in ninety-nine cases out of a hundred, in making two classes only and looking either to the lungs or the gastro-intestinal tract for—

1. As to fevers; these are, in nearly all cases, complicated by (or a part of) some derangement of the lungs or gastro-intestinal tract, though we must not lose account of the nerve-force impairment and the alkaloidal toxication by products of dissimilation, which affects the respiratory centre in the manner previously indicated.

2. As to lung derangements of gravity, especially with a febrile condition superadded, we can see how the various factors previously enumerated come into

play; the lessened force of circulation in the medulla oblongata, dependent on an over-worked heart, deteriorated by fever, the excessive heat of the blood, the imperfect oxygenation, the obliteration of alveolar space (equivalent to collapse) due to stasis and "logging."

3. As regards the gastro-intestinal tract; hiccough in its mildest *post-prandial* form, as well as in its more persistent demonstrations, is associated with distension with gases of fermentation, either subsequent to imperfect digestion, or to paresis of the intestine. (Dehio's case, Berliner Klinische Wochenschrift, June 3rd, 1889.)

Dilatation of stomach and catarrh—hiccough set up by distending the stomach with CO_2.

Gairdner in discussing what is called "gout on the stomach" says: "Very obstinate hiccough is a frequent attendant of this form of gout; it often comes on after sudden suppression of the urates by the kidneys," which agrees with what I have said regarding dissimilatory toxication, for we also know that hiccough is not an uncommon association with other effects of uræmia in Bright's disease, "Fagge, Vol. II, p. 619;" and we have indicated the true meaning of the "breathlessness" of muscular exertion, as depending not only on the demands of the blood to be freed from CO_2, but also, in great measure, upon the uricæmia thus induced.

Further, Bouchard (Recent Med. Congress, Rome) shows, and I quote his own words, that "the fever of indigestion, when too much food has been taken, or when the digestive process is sluggish, a meal is followed by a rise of temperature, either owing to greater energy of glandular activity, or to an influence exerted on the nervous system by products of imperfect digestion; this is the fever of indigestion, the fever of the dyspeptic. This dyspeptic fever is a reality; the flushing of the face, the dyspnœa, the excessive acceleration of the pulse are simply the results of reflexes set up by the contact of too large a mass of food with the normal mucous membrane of the stomach or of a normal mass with an excitable mucous membrane. This is the syndrome of a true fever, with elevation of the central temperature. I have seen this temperature rise to 39°·4 (102°·9F). As owing to the periodicity of meals these attacks are also periodic. I have seen such fevers treated with quinine. These fevers which are not rare in adults are frequent in children."

And you will allow that we have a condition in all points comparable to that shown to exist in the febrile and pulmonic associations of hiccough.

Having set forth the conditions upon which this reflex neurosis depends, it remains for me briefly to discuss its significance. I think we may take it that we need not look beyond the ordinary nervous mechanism of respiration to explain this spasm, although at least one able physiologist (Dehio of Dorpat) has thought it necessary to invoke a special "Hiccough Centre," while he at the same time quite neglects to assign its function or elucidate its meaning. Surely, a "reflex," with a centre all to itself, should have some present and abiding function or be the vestigial remnant of some ancestral vital reflex, but no attempt has been made to establish either alternative, and so I think we may safely look to the ordinary respiratory mechanism to explain what is evidently a respiratory fault or stammer; and when I say "fault" I would not impugn the obvious good intention which underlies it, for that it is purposive is equally clear, when the conditions are such as to call for a special inspiratory effort.

The blood is surcharged with CO_2 and with unoxydized products of metabolism, and there is stasis of the pulmonary circulation and embarrassed heart. I need not detain you with extracts from text-books on physiology, in order to remind you how all these circumstances are met by the inspiratory effort which, while it brings oxygen to the rescue, specifically promotes and accelerates the whole circulation, and especially the pulmonary venous sections thereof, and in this way, as well as by its action on the systemic blood pressure, brings relief to the embarrassed heart. (p. 367, 4th Edn., Foster).

Besides accelerating the pulmonary circulation, "the downward pressure of the diaphragm" (I quote Foster) "hinders the upward flow of blood from the abdomen and lower limbs." In precisely the same way, the first result of active exercise is to quicken the blood-current, and consequently congestion of the lungs is set up. Hence there arises great need of their disembarrassment by increasing the outflow from them. This is attained by the aspiratory force of inspiratory efforts which empty the congested capillaries, and widen the pulmonary veins and promote the velocity of the blood current through these channels. Hence the increased preponderance of inspiratory efforts in this condition of breathlessness, and the hiccough noted in its final stages (*vide ante*). This may be allowed to pass as a plausible explanation in the febrile and pulmonary association of the spasm, but some may still hesitate to accept it as fully accounting for the gastric and intestinal variety. I have shown that in this variety the general factors in action have a remarkable identity with those operating in fevers and lung congestions. We have hiccough of abdominal origin occurring almost exclusively in gastritis, acute and subacute, catarrhal states of the alimentary tract, in peritonitis, in contusions and ruptures of the intestines, in cholera and enteric fever. The two last, besides the local toxic conditions set up within the bowel, are in entire affinity with the febrile and pulmonary varieties; the rest are essentially associated with fermentative processes directly or indirectly through the paresis set up in the tract. In all cases, we have an irritation of the terminal filaments of the vagus transmitting afferent impulses to the medullary centre, and the efferent response is the same. It may be that CO_2 in the gastro-intestinal tract affects the vagus filaments there (*i.e.*, sends impulses to the respiratory centre), as we know it to do in the pulmonary alveoli. How else are Bouchard's reflexes set up? But in any case we know that large quantities of CO_2 formed within the alimentary canal are rapidly absorbed and evacuated through the lungs (Bunge).

It is also not inconceivable that stimuli affecting the gastric fibres of the vagus may occasionally be translated by the respiratory centre, as coming from the pneumonic fibres, as witness the transference of pain in hip-joint disease to the knee.

In hysteria and neurasthenia and in conditions of deterioration of the central nervous control, the reflex, when well established, may persist as a choræic habit for weeks, months, or even, as in a case reported from St. Louis (Putnam, New York Med., Assoc. Trans., Vol. V.), for years. In this last instance the husband secured a divorce.

Finally as to treatment; and a mere enumeration of the drugs and gymnastic attitudes which have been recommended in the medical journals during the past fifty years would lengthen this paper to double its present compass.

For practical physicians, severe hiccough has a special interest in fevers and pulmonary diseases as indicating a grave prognosis and in directing attention to blood stasis in the lungs and pulmonary arteries and to a failing right heart. The promptest measures should be taken to assist nature in her extremity, and these measures should be directed to secure the objects which the hiccough subserves:

Position in bed to be frequently changed, stimulating sinapisms to chest, cardiac and respiratory stimulants, alcohol ammonia, strychnia and atropin, in many cases an emetic. Possibly jugular phlebotomy in suitable cases, inhalation of oxygen, artificial respiration; citric and tartaric acids and their salts diminish blood coagulation (Wright.) In the gastro-intestinal variety not dependant on rupture of intestines, lavage or an emetic, with or without a full enema, followed by antiseptics and gastric sedatives. Lithæmic conditions frequently supply the key to rational treatment.

In chronic cases, besides the local treatment, one would seek to restore the tone and control of the nervous centres by tonics.

While the indications are being pursued, and where the recurrent spasm is exhausting a feeble subject (and it must be borne in mind that 30,000 to 40,000 of these racking convulsions frequently occur in 24 hours), I have found nothing so immediately and generally effectual as pressure with the thumbs and nails upon the supra-orbital nerves. We have discussed the inhibitory action of the fifth nerve. I have adopted this manœuvre in nearly every case with no failure that I can recall, and I believe the idea originated with a German clinician.

A NOTE ON A PECULIAR FORM OF FATTY LIVER IN MALARIOUS POISONING.

BY F. J. DRURY, M.B., B.CH.,
Surgeon-Captain, I. M. S.

Among the many works on the subject of malaria the numerous anatomical changes in the liver which result from it have not, I think, received that attention which their extent and importance would seem to deserve. Even in the classical works of Frerichs, Murchison, Hasley and Cornil and Ranvier this subject meets with but scant attention. Later, however, the French writers, notably MM. Kelsch and Kiener, have published the results of their investigations on the hepatic affections found in acute and chronic malarial intoxication, to which they have devoted much attention. These last writers, in their work on "Diseases of Warm Climates," have given up many pages to this subject in describing the various kinds of pigmentation, the atrophy, degenerations, engorgement, inflammation and cirrhosis which they have met with in the malarial liver.

During the past few years I have had abundant opportunities of examining the livers of patients who have died in the Medical College Hospital from malarious fevers or intercurrent affections; and I have been very much struck in many instances by the profound changes which the anatomical structure of the liver has undergone. Especially have I been interested in a form of degeneration of the liver cells by which most of them break up into a kind of granular *debris* and apparently lose their nuclei; in the different forms of cirrhosis, varying from a slight increase in the interlobular connective tissue to the formation of a mass of dense fibrous tissues by which one-half or two-thirds of the proper liver structure is replaced; and in those forms of pigmentation in which the granules of melanæmic pigment are contained in cells, apparently of extraneous origin, lodged in the inter-trabecular capillaries of the hepatic lobules.

However interesting it might be to embody these observations in the form of a paper, I shall content myself with referring to the work above quoted in which this subject is dealt with at very considerable length, and I shall limit myself to describing a form of fatty degeneration of the liver which, so far as I am aware, has not been noticed before, and of which I have met with several instances in the subjects of chronic malarial poisoning. This form of fatty degeneration of the liver I would propose to call "centro-lobular," from the fact that the hepatic cells in the region of the intralobular veins are primarily and chiefly affected.

In the more common forms of fatty liver, such as those depending on wasting diseases or alcoholism, or when the liver acts as a fat reservoir when there is excess of fat in the system, we find large and small globules of fat contained in the liver cells primarily at the periphery of the lobules gradually approaching the centre; and even in those cases in which we find all the cells of the lobule fatty it is the rule that the process is most advanced at the periphery of the lobule. The explanation of this is that the fat which is taken in with the ingesta is conveyed by the portal vein to the liver, and is deposited in those hepatic cells which are in closest proximity to the smallest branches of the portal vein, that is to say, at the periphery of the lobule. An exception to this rule is the fattily infiltrated liver of females during pregnancy and lactation, in which in a small area immediately round the intra-lobular vein we find droplets of fat distending the hepatic cells.

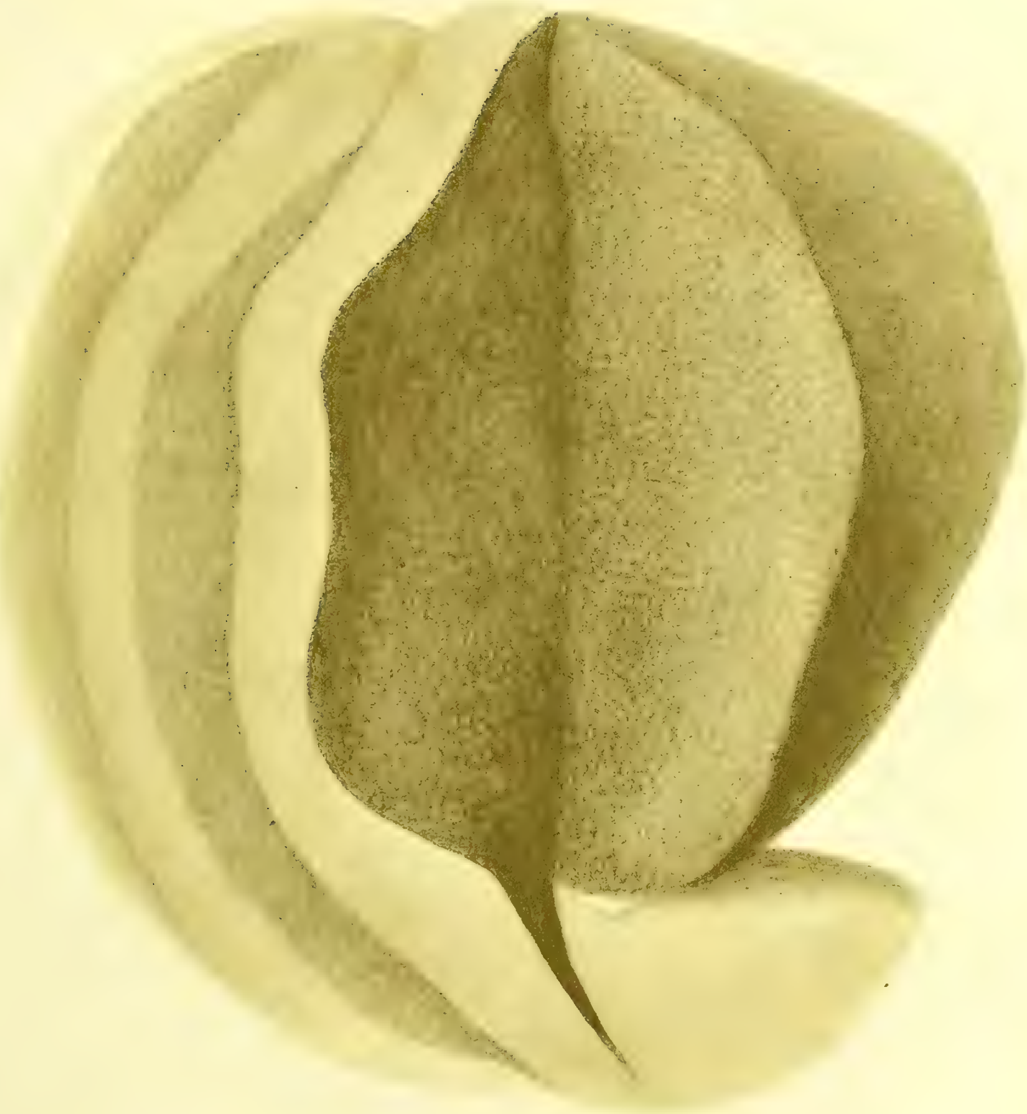

Fig. 1.

Liver of case No. 1, preserved in spirit, showing the marbled appearance of the cut surface due to the lobules being pale in the centre and dark at the periphery.

Photo.-etching.

Survey of India Offices, Calcutta, June 1895

This, according to Cornil and Ranvier, is a storing of fat in a position from which it may be readily drawn upon and carried off into the general circulation. In all these cases we generally find the liver cells of the affected region distended with several small globules or one large globule of fat. The cells often loses its polygonal shape and becomes round, the nucleus and protoplasm being, as it were, pushed aside. Sometimes the protoplasm forms merely a thin rim at one side of the cell, the nucleus projecting from it as a kind of knob, so that the hepatic cell comes to resemble a fat cell of ordinary adipose tissue. But both nucleus and protoplasm retain their power of staining with the ordinary re-agents.

In the form of fatty degeneration of the liver which I am here describing, and of which I have met with at least five well marked cases, we find a considerable zone of fatty degeneration of the hepatic cells immediately round the intra-lobular veins of the lobules. This gradually fades towards the periphery, so that we find a considerable number of hepatic cells at the periphery of the lobule, *i.e.*, immediately round the twigs of the portal vein comparatively unaffected. To the naked eye there is no special feature in the shape of the liver. It is enlarged usually, and the color varies according to the degree of pigmentation of the liver. In those cases where there is marked melanæmic pigmentation of the liver the general color is of a dark slatey grey, but in cases of absence of pigmentation the general color is of a pale brown. The most marked naked eye appearance is a distinct mottling which is seen, not only over the cut surface, but also under the capsule. This mottled appearance at first sight gives the appearance of a a "nutmeg" liver, but on closer examination it is seen that the different lobules are markedly pale in the centre while the periphery is dark. This appearance is well shown in the liver of case No. 1 (Fig. 1). The scrapings of the cut surface are found to contain a good deal of fat.

On examining a section of such a liver under a low power of the microscope, one is struck with the pale unstained appearance of the centres of the lobules while the cells of the periphery have a normal appearance. In the peripheral zone of the lobules the trabeculæ of liver cells are easily recognized, a few cells perhaps containing small droplets of fat; but round the centre of the lobules the cells appear to be collected together in a confused somewhat transparent mass, the nuclei however readily taking up the stain. In fact, as is seen under a higher power, the cell body has lost its staining power, while the nucleus stains freely. The appearance of these fatty cells differs according to the mounting medium employed. Thus in sections mounted in glycerine or Farrant's solution a large shining globule of fat is seen within each of the cells of the centre of the lobule, the cell protoplasm being only represented by a thin, faintly-stained rim at the outside. But in cases where Canada balsam is used for mounting the fatty cells appear almost homogeneously transparent, the fat globules having been dissolved out by the clearing oils. Another appearance observed in the case of uncleared sections, which is not observed in the case of those which have been cleared, is a number of tufts of acicular crystals of fatty acids lying among the mass of fatty cells. Looking at the cells of the periphery of the lobules, it is seen that those which are nearest the fatty area contain numerous small fat globules, but their protoplasm as well as their nuclei stain readily: these fat globules decrease in number as we approach the extreme periphery, until in the immediate neighbourhood of the interlobular vein the cells are quite free from fat.

In none of my cases have I observed cirrhosis to any marked extent. In three cases there was marked pigmentation of the liver, while in two there was no appreciable pigmentation, and in one case there was marked engorgement of the centres of the lobules due to dilatation of the heart and incompetence of the tricuspid valve.

CASE No. I.—Bayerdari, Mahomedan female, aged 13, admitted into the Medical College Hospital on 24th October 1892. She was a cooly in a tea garden in Assam for a year before admission. History of fever off and on for three months previously, was extremely anæmic on admission, and there was marked general œdema; liver and spleen were enlarged; constipation, continued fever not above 102° while in hospital. Death from asthenia on 3rd November 1892, or about a fortnight after admission.

Post-mortem.—Marked anæmia of all the organs, the blood being very watery and coagulating rapidly; slight œdema generally all over the body. Heart very pale, 5oz. pale serous fluid in the pericardium. Lungs very small and anæmic; marked greyish pigmentation of the membranes of the brain. Liver extended half inch below the costal arch, was smooth and of a slatish blue color, and had a mottled appearance; capsule not thickened. The cut surface of the liver presented a remarkably marbled appearance (Fig. 1) due to the fact that the lobules were of a dirty yellowish white color in the centre, while the peripheral parts were dark greyish in color; it weighed 1lb. 15oz. Spleen enlarged, weighing 4½oz., firm and slightly pigmented. Kidneys slightly pigmented and very anæmic. Innumerable anchylostomata found adhering to the mucous membrane of the duodenum and jejunum extending down the small intestine in gradually decreasing numbers right down to the ileo-cæcal valve.

Examined microscopically the lobules of the liver were found markedly fatty in a large area immediately round the intralobular veins; the trabecular arrangement of the liver cells in these areas is lost, but at the periphery of the lobules the trabeculæ are easily apparent (Fig. 3 LC.), and the cells round the portal veins appear free from fat. Numerous fat crystals are found among the fatty cells. In some instances the fatty areas of two contiguous lobules run together; the cells at the periphery where the two lobules come into contact undergoing a change similar to that which has taken place in the centre; but in the case of all the interlobular veins there is an area of hepatic cells immediately surrounding them, in which no fatty change has taken place. There is also marked melanæmic pigmentation of the liver, the pigment being distributed most abundantly around the peripheral zone of the lobules. But it appears to be contained almost exclusively within some large cells, which occupy the capillaries between the trabeculæ. What the origin of these cells is need not be discussed here. MM. Kelsch and Kiener say that they are of splenic origin; perhaps the supporters of the protozoon theory of malaria may regard them as pigmented amœbæ; they are at any rate much better marked than the so-called amœbæ, which are exhibited in the blood.

In the spleen there was melanæmic pigmentation, the pigment being distributed irregularly, sometimes in cells, sometimes apparently free throughout the section.

In the kidneys there was marked breaking down and fatty degeneration of the epithelium of the cortical tubules.

CASE No. II.—Bailie, Mahomedam female, aged 14, sister of the preceding, and had been living under similar conditions for a year. She was admitted into the Medical College Hospital on 24th October 1892 and died on the sixth day. Had had fever for the previous three months and had been œdematous for a fortnight. On admission she was extremely anæmic and there was extensive œdema marked over the whole body: the temperature ranged very high while in hospital, occasionally reaching over 105°; diarrhœa also set in, and she gradually sank and died.

Post mortem.—All the organs were anæmic, and there was fluid in the serous cavities and in the subcutaneous tissues. The liver was enlarged, weighing 2lbs. 8oz., was smooth, of a brownish slate color, mottled with dark grey and reddish brown. Spleen also enlarged, soft in consistence and of a dark maroon color. Kidneys fatty, no pigmentation of brain or kidneys. There were numerous anchylostomata in the small intestine from the jejunum downwards, till near the lower end, and numerous ecchymoses in the mucous membrane from their bites.

Histological examination of the liver.—There was found in the centres of the lobules a change similar to that found in Case No. I, but this is much less marked, and the area of fatty degeneration is smaller. In the case of some of the hepatic cells also the protoplasm has apparently totally disappeared. The affection of the liver therefore seems to be similar to that described in Case No. I, but in an earlier stage. There is also extensive pigmentation of the liver, but the mode of distribution of this pigment is quite different from that in Case No. I. Instead of being confined to cells, included in the inter-trabecular capillaries, the pigment is distributed in small brownish black granules in the cells of the trabeculæ towards the periphery of the lobules (Fig. 4 P.C.), apparently affecting very few of the fatty cells towards the centre.

CASE No. III.—Was that of a Madrasee Native Christian woman who was admitted into the Eden Hospital on 19th June 1894, and died within an hour after admission. She had been confined a month previously and had been suffering from diarrhœa for 15 days.

Post-mortem.—All the organs were found to be very anæmic except the spleen which was enlarged and congested. There was purulent pericarditis and marked œdema of both lungs. The liver weighed 2lbs. 8oz. and pitted on pressure; lobules well marked and slightly swollen; on section the lobules were very distinct, the part between the intra- and interlobular veins standing out very distinctly from its pale color.

Histological examination of the liver.—In this case the distribution of fatty degeneration about the intralobular veins and almost confined to this region is very well shown. In sections stained with picrocarmine and mounted in Farrant's solution the central parts of the lobules appear under a low power to be remarkably transparent, scarcely taking up any stain (Fig. 5), while the nuclei show up very distinctly stained brilliantly with carmine. Under a higher power the protoplasm of the central cells is seen to be almost completely replaced by fat, only a thin rim being left at the margin of the cell (Fig. 6 F.C.) At the periphery of the lobule the hepatic cell (Fig. 6 L.C.) are quite normal in appearance, only a few containing small globules of fat. Here and there lying among the fatty cells are seen beautiful tufts of acicular crystals of fatty acids (Fig. 5 F.C. Fig 6 F.A). There was no pigmentation of this liver.

CASE No. IV.—Sukree, Hindu female, aged 17, admitted into the Medical College Hospital on 28th August 1893 for malarial cachexia and died on 3rd Octber 1893. Gave a history of fever for three months before admission. She was badly nourished and had a considerably enlarged spleen and liver. There was a daily rise of temperature to about 101° while she was in hospital: dysentery supervened after a month and she sank and died.

Post-mortem.—The body was considerably emaciated. Brain very anæmic. Heart fatty, numerous minute subendocardial ecchymoses in both ventricles. Lungs small and œdematous with numerous minute subpleural ecchymoses. Liver large and flabby with slightly rounded edges; its substance on section was found to be firm and bile-stained, and the lobules were distinctly marked out, being very pale in the centre and darker at the periphery: gall bladder two-thirds full of viscid tawny bile. Spleen enlarged, firm and pigmented. Kidneys very anæmic. Mucous membrane of large intestine swollen throughout and eroded with numerous small superficial ulcers. Uterus and ovaries small and undeveloped.

Histological examination of the liver.—The microscopical appearance of this liver were very similar to those of Case No. II except that the area of fatty degeneration round the intralobular veins was more extensive (Fig. 7.) The mapping out of the section into pale fatty areas round the central veins and into darker-stained non-fatty areas round the interlobular veins is vere distinctly seen. There is also marked pigmentation of the cells at the periphery of the lobules with numerous minute brownish black granules of pigment.

There was considerable destruction of the epithelium of the convoluted renal tubercles.

CASE No. V.—This was a case which died in the Medical College Hospital with dilatation of the heart and tricuspid regurgitation. I have been unable to obtain either the clinical notes or the post-mortem notes of this case. I have only a note on the microscopic appearances of the liver. In this case the area of fatty degeneration in the centres of the lobules is very extensive, and in the case of many lobules only a small area of unaffected liver cells is found surrounding the interlobular veins. In addition numerous lobules have an area of intense engorgement immediately surrounding the intralobular veins: this condition is accounted for by the dilatation of the heart and tricuspid incompetence.

In all these cases we have not a mere infiltration of the hepatic cells with fat but a fatty degeneration, and that too occurring in a position in the lobule where we do not find it in ordinary cases; while that portion of the lobule which, in ordinary fatty livers, we find most affected is, in those cases which I have described, comparatively unaffected.

In four out of these five cases we have as a common condition extreme anæmia: the same four cases were females, whilst in the other case (No. 5) the sex is not known. In three cases also there was undoubtedly malarial poisoning; but in the other two no previous history is available. It is on account of these three cases in which the clinical history and morbid appearances correspond to what we expect from experience to find in cases of severe malarial poisoning that I have attributed the peculiar degeneration of the liver to be due to malaria. I believe that the poison of malaria, whatever that be—for I think that in spite of all that has been written about it we are far from understanding it yet—that this poison reaching the liver by the portal circulation so interferes with the nutrition of the hepatic cells that they undergo a fatty change.

How are we to account for this anomalous distribution of the fatty degeneration round the intralobular veins? Only two explanations occur to me, and these I offer as the barest suggestions, hoping that those who are working on these lines may direct their attention to this question when they meet with similar cases. It will be remembered that all four of my cases in which the sex is known were females. Usually in females, as well as in males, fatty degeneration affects first and chiefly the peripheral parts of the lobules gradually extending inwards. In females, however, in the last months of pregnancy and during lactation, the cells of the hepatic lobules for some distance round the central vein become fatty. MM. Cornil and Ranvier regard this condition as a mere fatty infiltration, a storing of fat in that portion of

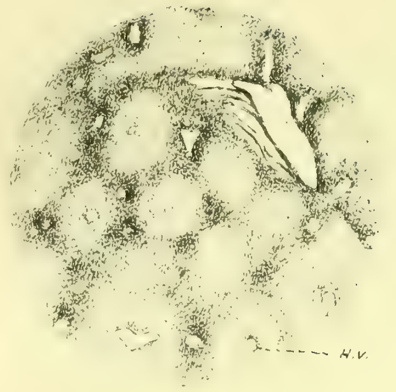

FIG. 2.

Section of liver of case No 1, stained with lithium-carmine and picric acid and mounted in Canada balsam.
H V. Intra lobular vein × 20.

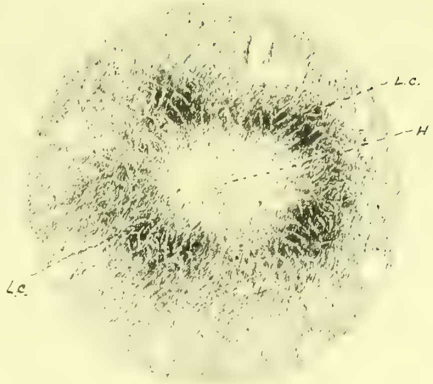

FIG. 3.

Section of liver of case No. 1, stained with hæmatoxylin and mounted in Canada balsam.
H. V. Intra-lobular vein, surrounded by a faintly stained area of fatty cells
L. C. Healthy liver cells round inter lobular veins.
Zeiss obj. A. A. oc. 2.

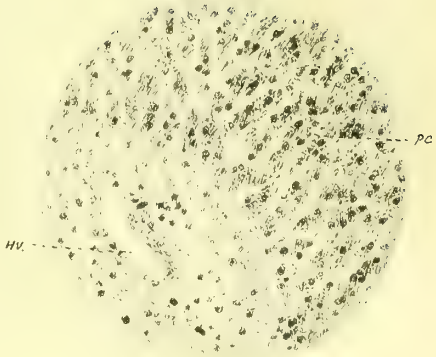

FIG 4.

Section of liver of case No. 2, stained with hæmatoxylin and mounted in Canada balsam.
H. V. Intra lobular vein surrounded by hepatic cells with distinct nuclei, but faintly stained protoplasm.
P C. Pigmented cells.
Zeiss obj D oc. 2

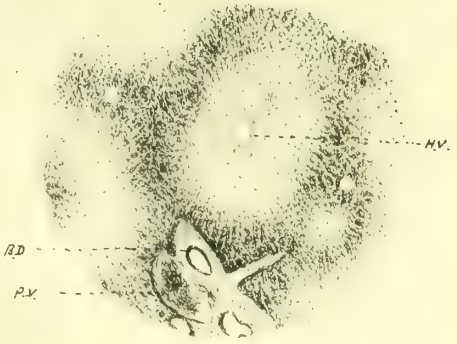

FIG. 5.

Section of liver of case No 3, stained with picro-carmine and mounted in Farrant's solution.
H. V. Intra-lobular vein.
P. V Inter-lobular vein.
B. D. Bile duct
Zeiss obj. A. A. oc. 2

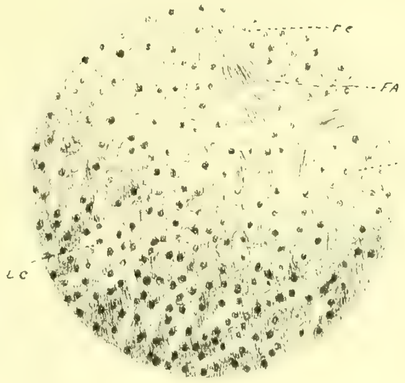

FIG. 6.

Section of liver in case No. 3 stained with picro-carmine and mounted in Farrant's solution
F. C. Fatty liver cells.
F A. Fatty acid crystals
L. C. Healthy liver cells.
The inter-lobular vein is not shown
Zeiss obj D. oc. 2.

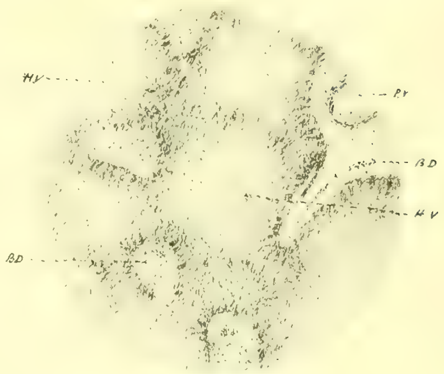

FIG 7.

Section of liver of case No 4, stained with hæmatoxylin and eosin and mounted in Farrant's solution
H. V. Intra lobular vein.
P. V. Inter lobular vein.
B. D. Bile ducts
Zeiss obj A A oc 2.

All reduced one-half from original drawing.

Photo-etching

Survey of India Offices, Calcutta, June 1895

the lobule from which it may most readily pass into the hepatic vein, in order to supply fatty materials for the formation of milk. This explanation seems to me to be open to question, inasmuch as we have good reason to believe that all the fat found in the milk is elaborated by a fatty metamorphosis of the epithelial cells of the mammary gland. May we not rather with greater probability regard this fatty change in the centres of the hepatic lobules as a true degeneration, brought about in the cells of this region by the deleterious influence on their nutrition of toxic substances which are believed to be circulating in the blood of pregnant females? As an instance of a similar change in other organs I need only mention the fatty degeneration of the renal epithelium which is often found in pregnant women: how are we to explain this except as the effect of noxious materials in the blood in circulation?

It may be asked, as these four cases were females, may not this fatty condition of the liver be merely the ordinary fatty change which we meet with in pregnancy and lactation? In the first place I reply that the fatty condition is very much more advanced than we usually find it under these conditions; and, secondly, that, although in one case (No. 3) delivery had occurred one month previously, yet the other three females were nulliparæ.

To account for this central distribution of fatty degeneration in the hepatic lobules in pregnancy and lactation I can only suppose that in females the cells of this region must have an inherent tendency to become fatty under certain conditions: that on the one hand pregnancy almost always furnishes these conditions, and on the other hand the poison of malaria may act in a similar way—causing a fatty degeneration of certain sets of cells which have an inherent tendency in this direction. I am well aware of the danger of arguing from four cases only that this peculiar fatty degeneration of the liver which I have described is limited to females, and I quite admit the possibility of a similar condition being found subsequently in males: I venture to throw out this suggestion merely as a hypothesis which seems to me to accord best with the material in my hands.

I have one other suggestion to make to explain this central distribution of fatty degeneration in the hepatic lobules in malarious poisoning, though it does not explain its apparent limitation to females. This is, that in malarious poisoning toxic materials are absorbed from the intestinal canal, and being distributed in the liver by the portal circulation, so affect the nutrition of the hepatic cells around the ultimate portal capillaries, *i.e.*, in the central parts of the lobules, that they undergo fatty degeneration.

I feel the inadequacy of these hypotheses to account for the fatty condition of the liver which I have described; but I have thought that the condition itself was sufficiently interesting to place it on record.

In conclusion I have to express my thanks to Babu Dhir Lal Das, of the Medical College, for the care he has taken in executing the drawings.

CARLSBAD AND ITS THERMAL WATERS FOR ANGLO-INDIANS.

BY SIR J. FAYRER, M.D., F.R.S.

My old friend, Surgeon Colonel Harvey, President of the Calcutta Congress, having requested me to contribute a paper on the advantages of a visit to Carlsbad by Anglo-Indians who are suffering from the effects of climate and tropical disease, I have much pleasure in complying with his request, knowing from personal experience and observation of the results to many who have gone there on my recommendation that great benefit is often conferred, not only on those who have had to leave India on sick furlough, but on others who have retired from the service and still suffer from the consequences of prolonged sojourn in a hot and malarial climate.

It has always appeared to me that this most valuable of health resorts is neither sufficiently known nor appreciated, and that erroneous impressions as to the depressing and debilitating effects of the waters and diet exist which better knowledge would probably remove.

Carlsbad, like other health resorts, is not suitable to all complaints, but for a large number of chronic functional disorders, to which old Indians especially are liable, it is often of great and enduring value. I should be glad, if I could induce those to whom I believe it is so well adapted to try it either on their way to England or later; and I believe that if many who have retired from the services would spend a month or three weeks there every year for two or three years they would probably derive lasting benefit

Carlsbad, which is easily approached by those returning from India *viâ* Venice or Trieste, is situated in the north-west of Bohemia, not far from the Saxon and Bavarian frontiers. It is in 50° 13′ N. latitude and 12° 53′ E. longitude. The town itself, which is 1,200 feet above the sea, lies in a valley through which the Tepel, a bright trout stream, flows to join the river Eger, their confluence being in close proximity to the town, which is built on the banks of the river and on the hills which rise in terraces on either side in most picturesque forms, one, the Ewigleben, being 800 feet above the town. They are densely wooded with magnificent pine, spruce, beech, birch and other trees. Through these woods innumerable well-kept paths and roads lead to fine points of view of the town and neighbouring hills, the Erzgebirge and other mountains, and of the ranges of forest country which stretch away to the Böhmerwald. The Tepel and the Eger are beautiful streams, with picturesque and in some places rocky banks. In the woods the odour of the pines is often very perceptible; they afford pleasant shade during the summer and enable visitors to spend much of their time in the open air.

The weather is variable, the temperature at night and the morning being subject to marked changes. The mean temperature of the year is 43° F.; of summer 66·5° F.; but in July and August there are days of great heat as there are in many other places. In the spring and autumn it is 47° F. in the winter 27° F. The prevailing winds are from the west and north, the latter being cool and bracing in summer.

The annual rainfall, according to a return kindly supplied to me be Dr. Schuman Leclercq, a resident physician at Carlsbad, is as follows :—

January ...	1·46 in.	July ...	2·77 in.
February ...	1·99 „	August ..	0·91 „
March ...	1·26 „	September ...	2·05 „
April ...	0·01 „	October ...	1·89 „
May ...	3·89 „	November ...	2·51 „
June ...	1·03 „	December ...	0·78 „
		Total ...	20·55

The source of the mineral springs is in a vast reservoir at a considerable depth below the surface. Great part of the town is built upon the Sprudelstein, a hard calcareous crust deposited by the water.

Carlsbad has always been remarkable for the purity and salubrity of its atmosphere. No contagious epidemic has ever visited the town. In the Austro-German war, when cholera prevailed in the surrounding districts, Carlsbad was exempt.

The population is of a very mixed character, especially in the season which extends from May to September, when it is visited by people from almost all parts of the world. The waters are accessible at all times of the year, but few people resort to them during the winter months, when it is cold and dreary and the ground covered with snow. A considerable number remain till November, but after that there are very few visitors. The resident population is about 12,000, the visitors about 30,000 annually.

The warm springs of Carlsbad, though apparently unknown to the Romans, have long been famous for their medicinal virtues. A legend says they were discovered in the 14th century by the Emperor Charles IV. during a hunting expedition. Whatever may be the truth of this story, there is no doubt that the town owes its name, and probably its existence, to that Sovereign, but it is only within the last century that they have attained their present widespread reputation. It would appear from the records of the place that at one time they were drunk in inordinate quantities—an abuse which probably laid the foundation of prejudices which still exists, but are gradually disappearing as more judicious use of the waters and the baths has shown their efficacy in the treatment of numerous forms of disease and functional disorder.

The hygienic condition of the town, on the whole, are good, but a more complete system of drainage is on the point of completion, which will leave little to be desired from a sanitary point of view. Engineering difficulties connected with the springs have hitherto impeded the progress of this work, but these appear to have been overcome and the desired object attained. Meanwhile the low death-rate and absence of epidemic disease points to a high state of salubrity.

The Carlsbad springs yield warm alkaline, saline waters. They are clear and sparkling, free from any disagreeable taste or smell and vary in temperature and amount of free carbonic acid, and they all contain the same solid constituents, the proportion varying in only a very slight degree, and all come from one common source emerging at no great distance from each other, the differences in temperature and amount of carbonic, and depending on the depth from which they come and the nature of the channel by which they reach the surface. They all—the Sprudel especially—deposit a yellowish or dark brown crust consisting of calcareous, silicious earth with traces of iron. These are kept in solution by the carbonic acid, which, being parted with on coming to the surface, occasions the deposit which has formed the crust before referred to on which part of the town is built and which colours the ground and rocks wherever surplus Sprudel water flows.

There are numerous springs in Carlsbad. Those chiefly in use are the Sprudel, Muhlbrunn, Schlossbrunn, Marktbrunn and Felsenquelle. Around these numbers of patients congregate, the others are less in request. To the differences which exist between the springs, such as they are, the experienced physicians of Carlsbad attach considerable importance, as may be seen by the greater attendance at some than at others.

The active constituents in these waters are sulphate and carbonate of soda and chloride of sodium; no doubt the other salts contribute some share in determining their efficacy.

The following table, according to Dr. Kraus, gives the temperature and chemical composition of the springs :—

Names and temperatures of the thermal springs now in use at Carlsbad.

Sprudel	162° F.
Hygieaquelle	162°
Marktbrunn	111°
Kaiser Karlsquelle	119°
Russische Krone	95°
Schlossbrunn	129°
Muhlbrunn	129°
Neubrunn	141°
Theresienbrunn	139°
Bernhardsbrunn	150°
Elisabethquelle	109°
Felsenquelle	140°
Kurhausquelle	149°
Kaiserbrunn	120°
Parkquelle	99°

Many analyses of the Carlsbad waters have been made. They give an average of 41 to 42 grains of solids in each pound of water. The differences in the various analyses are so trifling as not to require notice.

Solid constituents of three principal springs.

		Sprudel.	Muhl.	Schloss.
Sulphate of Potash ...		1·2564	1·7172	1·4645
Sulphate of Soda ...		18·216	17·961	17·2455
Chloride of Sodium ...		7·9156	7·869	7·5282
Carbonate of Soda ...		10·4593	10·868	9·5620
Carbonate of Lime ...		2·2870	2·0236	3·0658
Carbonate of Magnesia ...		0·9532	0·2641	0·3870
Carbonate of Protoxyd. Iron ...		0·0215	0·0230	0·0173
Carbonate of Protoxyd. Mangan.		0·0046	0·0053	0·0053
Carbonate of Strontia ...		0·0061	0·0069	0·0016
Phosphate of Aluminium ...		0·0030	0·0025	0·0023
Phosphate of Lime ...		0·0015	0·0016	0·0030
Fluoride of Potassium ...		0·0276	0·0268	0·0291
Silicious Earth ...		0·5590	0·6190	0·7365
Total of solid constituents ...		41·7090	41·3870	40·1523
Free Carbonic Acid	in grains	5·876	7·3260	10·2940
	in cub. in.	1·8820	14·8370	20·6260

Traces of lithia, boracic acid, iodide of sodium, bromide of sodium.

One spring called the Eisenquelle differs entirely in its constituents from the others, and is probably from a different source. It contains a small quantity of iron, and is used as a chalybeate. Its temperature is only 48° all the year round. There are one or two others, such as the Saverbrunn, which contain few mineral constituents, but are largely impregnated with carbonic acid gas ; they form pleasant drinking water.

A favourite drinking water, which contains a quantity of carbonic acid, and is much used in cases of uric acid and gout, is brought from the Gieshubler-Puchstein springs, a few miles distant from Carlsbad. All the other springs lie within a radius of half a mile from the centre of the town.

Bathing is an essential part of the treatment for some complaints. The mineral baths consist chiefly of the Sprudel water, the temperature varying from 90° to 100°, to which the pine needle extract is sometimes added. The peat or mud bath is also frequently used ; it is a thin, pulpy mass, made of peat which comes from Franzensbad, mixed with Sprudel water, and is used at a temperature of 90° to 104°. Vapour baths and douche baths are also much in use. The iron water baths are supplied by the chalybeate springs before mentioned. Acidulous baths are supplied by the Saverbrunn springs. The peat baths are much in use in gouty and rheumatic swelling and exudations.

The therapeutic value of the Carlsbad waters depends chiefly on the sulphate of soda, which has a gentle purgative action. The carbonate of soda neutralises acid, the chloride of sodium and other constituents combined with carbonic acid, and in conferring on the water its solvent powers and materially contribute to the solution of various exudations and concretions which may be forming or have formed. The general effects are promotion of defæcation and diuresis, absorption of fat and modification of metabolism promoting a favourable influence on the blood formation, improving digestion and nutrition and the integrity of the functions generally.

The waters, which are usually taken early in the morning, sometimes also in the evening, in quantities varying from 2 to 6 tumblers in the 24 hours, according to circumstances, are agreeable to the taste. They produce gentle action of the bowels with flatus strongly tainted with sulphuretted hydrogen. The stools are at first of a dark green or blackish appearance and contain increased secretion of thick bile ; the dark colour is partly due to the result of decomposition of the sulphate of soda and consequent formation, with the traces of iron in the water, of sulphide of iron.

After a few days' use of the water, the quantity of urine is considerably increased and the acidity is diminished, but an alkaline reaction, Kraus says, is never induced. Seegen shewed decrease in uric acid and urea with a corresponding increase in phosphoric acid. The mucous membrane soon shews more vitality, and increased secretion consequently follows. The nervous system is energetically influenced.

The good effects, though often manifested early, are not so always, and the patient may leave Carlsbad apparently no better than when he went there ; but improvement so frequently occurs later as a result of the treatment that it would be unwise to pronounce unfavourably on leaving the place.

It is not necessary in this brief notice to say more on the general action of the waters. It is obvious from the above how peculiarly they are indicated in many functional disorders of tropical residents. Their salutary effects are, of course, greatly enhanced by the circumstances under which they are taken, such being the change of air and surroundings, the perfect rest, open air life, moderate exercise, the well-ordered dietary mental relaxation, the absence of work and worry, the mental attitude of a society whose chief aim and object is to do all that is conducive to restoration of health.

I do not venture to indicate the respective merits of the different springs ; all—as before shewn—contain the same constituents, yet they have different actions, and therefore are respectively applicable to different cases. Their special indication as well as the amount of exercise, the nature of the diet, quantity of stimulant and duration of the stay at Carlsbad, can only be authoritatively laid down by one or other of the able physicians on the spot. The question of bathing, in addition to the internal use of the waters, must equally be determined by local medical authority, and the nature of the baths, whether simple Sprudel water, peat, vapour or douche, will depend on the special symptoms in each case. The same may be said of massage.

I feel convinced that, rightly used, with due attention to diet, habits and mode of living, the Carlsbad waters are capable of conferring great benefit, without the depressing effects so often attributed to them, but the cases for which they are appropriate must be carefully selected. Organic diseases of all kinds, especially if in an advanced condition, should not as a rule be sent there, though in the earlier stages of some so much improvement in the general health may result as to retard their development and ameliorate the condition of the sufferer. But when the cases which are not appropriate are excluded, a number still remains for which the benefit will be great indeed.

The nature of the ailments for which the waters are applicable has been clearly pointed out by many authorities, whilst the necessity for care in respect of mode of life, diet and occupation, the importance of travelling slowly, the need for repose and sojourn in some bracing locality after the treatment, and delay in return to work and to those causes by which the original trouble was induced, have been equally insisted on, and I can only say that they apply as much to invalids from India as from elsewhere. It remains only briefly to notice the conditions for which Carlsbad is likely to be useful to Anglo-Indians.

The waters are indicated in the following disorders : In congestion and functional derangement of the liver, in catarrhal jaundice, in gall stones or inspissated bile and in chronic hepatic enlargement in which serious structural change of the amyloid or other degenerative process have not taken place. In chronic engorgement of the portal system, in catarrhal conditions of the mucous membrane of the intestines and congestion of the hæmorrhoidal vessels ; also in habitual constipation, incipient hæmorrhoids and even in the earlier stages of tropical diarrhœa. In diseases of the spleen, such as chronic hyperæmia and enlargement, resulting from malarial poisoning. In chronic gastric catarrh ; in cardialgia or gastralgia, dyspepsia, dilatation of the stomach. In those forms of albuminuria which take place as the result of abdominal plethora and changes in the blood due to malarial poisoning. In renal and vesical gravel ; in lithiasis ; also in chronic catarrh of the bladder and in hyperæmia of the prostate gland, and in some hyperæmic conditions of the womb and its appendages. In gouty conditions, whether expressed in affections of the abdominal or other viscera ; in arthritic effusions and in thickening of the tissues and sheaths of the tendons surrounding the joints ; in excema, and in fact, in any of the other modes in which the gouty diathesis manifests itself, also in general abdominal plethora and in obesity, whether of the abdomen or of the body generally.

In the earlier forms of diabetes there seems little doubt, from the testimony of eminent authorities, that benefit may be derived.

But Carlsbad is to be especially recommended to those who, after protracted residence in India or other malarial climate, suffer from occasional recurrences of malarial fever, with consequent derangement of function and even alteration in the normal condition of liver, spleen and other abdominal viscera ; who, without suffering from any positive disease, are failing in health, have impaired digestion, distended condition of the abdomen, increasing fatty deposit in the omentum and a tendency to fatty degeneration of the muscular system generally, who find themselves languid and depressed, unequal to much physical or mental exertion, shew indications of incipient anæmia, suffer from dyspnœa, from rheumatic or gouty pains, irregular action of the bowels, congestion of the portal system and distended hæmorrhoidal vessels—a state of things, perhaps in some cases aggravated by excesses or irregularities of diet, or the neglect of due precautions as to the quantity or kind of alcoholic stimulants.

Such are the conditions in which an early recourse to Carlsbad and a judicious selection of some intermediate health resort before returning to the ordinary mode of life are likely to confer benefit. Indeed, almost every European not the subject of organic disease, who has spent many years in India, would do well to avail himself of the resources of Carlsbad before he enters upon the new course of life which lies before him, whether he be returning to India from furlough or retiring to spend the remainder of his life at home.

It is almost needless, after what has been said, to add that diseases of the brain or spinal cord, severe forms of fever and suppurative processes, intestinal or pulmonary tuberculosis, malignant growths and syphilis, diseases of the heart and blood vessels, hæmorrhagic diathesis, excessive menstruation, profuse hæmorrhoidal flux and well-developed hæmorrhoids, severe anæmia or cachexia and atrophy, cirrhosis or malignant disease of the liver and ascites, Bright's disease or albuminuria depending upon renal disease, the advanced forms of diabetes and neurasthenia, will derive no benefit.

I have not attempted in this brief sketch to point out all the conditions that might be benefited by Carlsbad, but have selected those in which it may be profitable to my countrymen in India. My object is simply to call attention to it as a health resort which appears to me to be very suitable for many of them, and to discourage notions, which I fear still prevail, that risk of excessive spoliation by the waters and depletion by starvation is incurred, for neither of these results need be apprehended, whilst the local advantages of climate, scenery and healthful recreation are such as contribute greatly to the therapeutic value of the mineral waters and consequent restoration to health.

THE MACRO-PATHOLOGY OF CONSTITUTIONAL MALARIA WITH SPECIAL REFERENCE TO ITS TREATMENT BY ALKALINE SALINE MINERAL WATERS.

BY L. T. YOUNG, M.D.,

Surgeon-Major, I. M. S.

English text books of medicine are uniformly unkindly curt, unsatisfying and often misleading on the subject of the constitutional effects of malaria.

These books form either in the original, or as translations, the universal guides to a systematic knowledge of malaria for Indian medical students.

The present appears to me a fitting opportunity for collating, comparing and crystallising out the crude impressions we have one and all acquired in the course of our practice or study in this country.

If this representative meeting gives expression to its impressions of the constitutional effects of malaria and the methods of averting or removing them, it might possibly lead to clearer and more precise accounts of this subject finding their way into both English and American text-books of medicine. The French, Italians and Austrians have a knowledge of malaria far superior to ours.

The subject is an important one, both to ourselves and to the State. To ourselves, because we are all certain sooner or later to suffer more or less from malaria; to the State, because fever alone causes more death and invaliding than cholera, small-pox, dysentery, &c., do collectively.

I venture to lay before you the following generalisations and facts, and invite you to suggest others and to discuss and reject any which seem to you inaccurate or incomplete.

At the same time I would remind you that malaria differs in its effects in the different climates of this vast empire, and that different observers have had diverse opportunities of noting clinical and pathological facts, or may have utilized these opportunities differently. My experience and conclusions have been drawn from the dry Punjaub, alternately very hot and very cold as the seasons change. The first point to which I would direct attention is that—

The *treatment of malarial fever should be divided into two stages*—

(a.) Curing the attack by temporarily killing the malarial organism; and

(b.) Removing the condition of the abdominal organs and mucous membranes induced by it.

This *latter* is often *the more important of the two*, and enables the *vis medicatrix naturæ* to throw off the disease better than anti-malarial remedies would enable us to do.

Before discussing the use of alkaline salines in the treatment of malaria it will be necessary to very briefly consider the pathological conditions produced by malaria and their functional effects.

Even a rather casual inspection of numerous autopsies will, I think, lead to the adoption of the opinion that malaria congests the internal abdominal organs and causes catarrh of the mucous membranes.

A proper recognition of these two facts and their results may be considered the key to the successful treatment of the constitutional effects of malaria.

A.—Malaria congests the internal organs—

(1.) *Liver.*—Is it not rare at an Indian autopsy to find a liver free from congestion of some form or other? In many the appearances are distinctly those of incipient "nutmeg" congestion, whilst in advanced malarial cases there is distinct cirrhosis of a hypertrophic kind—following to some extent as the result of long-standing congestion, according to the well-known pathological law.

This cirrhosis is not the ordinary "hob-nailed," contracted-surfaced form, but the enlarged, hypertrophic morocco-leather surfaced, which commences in and around the bile ducts, and which, I venture to suggest, begins as a catarrh of these channels in a manner similar to that in which catarrhal malarial enteritis supervenes on tropical intestinal catarrh.

Tropical hepatic congestion is always associated with more or less fatty infiltration of the liver cells.

Results.—The acute results comprise hepatitis, abscess, perihepatitis, dysentery, catarrh of the bile ducts, &c. The chronic embrace the various forms of imperfect proteid metabolism or liver indigestion, also gout, rheumatism and possibly diabetes, &c.

(2.) *Spleen.*—The early congested and the late cirrhotic stages are only too well known.

Results—The organ or its capsule sometimes inflame; the enlargement of the organ may reach an enormous size sufficient to fill the entire abdomen almost. In the later stages ascites supervenes, anæmia and debility with a tendency to sudden death from pulmonary thrombosis as so ably described by Sir Joseph Fayrer.

(3.) *Kidneys.*—These are nearly always found congested, often intensely so. Of the later stages, the large white has been the most frequent result of my own observations, not the cirrhotic form as one would have expected.

Acute desquamative nephritis is not a rare complication of severe malarial fevers, and it often in the slighter degrees is overlooked, and gradually assumes the fatal chronic form.

The dietetic errors to which Anglo-Indians, as a class, are so much addicted, are also largely to blame for many cases of Bright's disease.

Two or even three large meat meals daily, with many richly seasoned courses, mostly flavoured with sauces and vinegar, both so injurious to the prevalent tropical intestinal catarrh, are, as a rule, indulged in. Consider these acted on by—(1), a weak and imperfect gastric juice secreted by a dilated stomach, the glands of which are atonic, atrophied or catarrhal; (2), the imperfect bile secreted by a chronically congested liver. Consider that even this gastric juice has been diluted out of all semblance of even its feeble orginal digestive activity, by copious draughts of tea or of whiskey and soda drunk during meals.

It is little to be wondered at if persons, whose digestion is conducted under these conditions, are likely to ultimately suffer from renal mischief.

This result is further contributed to by the lives of hard work Anglo-Indians lead out here. The idea that India is a country of ease and plenty has long since exploded. It takes as hard, if not harder, work to succeed in life out here as it does in Europe.

Many find themselves when sadly in need of sick leave to Europe or the hills unable to afford it. They struggle on for a few years longer and break down or die in doing so. Few can now buoy up their sinking energies by looking forward to retiring with a competence, much less with wealth.

The conditions of existence in the tropics are yearly becoming harder, less elastic, more discouraging. This cannot fail to react upon the general health and constitution of tropical residents. My own impression of these altered conditions of life in India is that the kidneys now break down oftener than previously. Another factor in producing renal disease is the continued elimination by them of the irritating products of imperfect proteid metabolism. This latter is a common result of constitutional malaria and of cirrhosis. In an advanced case of tropical cirrhosis the ureameter showed only 0·5 per cent. as the daily excretion of urea.

(4.) Chronic liver congestion also acts mechanically in congesting the stomach, bowels, uterus, ovaries, rectum, &c. Hæmorrhoids are common. These are often accompanied by a permanently moist condition of the anus with a purulent discharge from it.

The uterus is often found enlarged, softened, displaced, its ligament relaxed and its interior endometritic. The ovaries become the seat of congestive pains, more marked during the actual attacks of fever.

This condition of the uterus is in my opinion a result of the extension of endometritis to the parenchyma of the organ and not a direct result of malarial congestion.

B.—*Malaria causes catarrh of the mucous membranes.*

Tropical residence from the extreme and rapid differences of temperature to which we are subject, and from the excessive humidity of the air during the rainy season, &c., also contributes to the same result.

All the mucous membranes of the body become sooner or later affected by catarrh from the above causes. Pharyngeal and laryngeal catarrhs are generally the earliest to occur. The latter spreads with great frequency up the Eustachian tube, giving rise to otitis media, which often goes on to suppuration with loss of the membrana tympani and ossicles or to plastic inflammation sealing up the ossicles into the fenestræ and so causing deafness.

The Schniederian membrane shares the same fate, and hyperplasia of it over the turbinated bones is a common result. Slight chronic ophthalmia attacks the conjunctivæ. The lining of the uterus becomes endometritic.

The most important *catarrh*, however, is that *of the stomach and intestines.*

Under the influence of repeated "long drinks," large meals and hot weather the stomach becomes dilated. Its glandular structures degenerate and atrophy leading to the secretion of a gastric juice imperfect in quality. You may perhaps have observed that an ague patient, who has had a drink of milk half an hour previously, brings it up, perfectly uncurdled, showing the complete absence of acid from his stomach. The thickly loaded, large, flabby, indented "*tropical tongue*" is a frequent sign of tropical gastric catarrh.

The intestinal catarrh often causes not alone obstructive jaundice, but ramifies and extends along the bile passages in its more chronic forms. This, as I have already suggested, may act as the starting point of biliary cirrhosis.

Catarrhal enteritis is a common and extremely fatal consequence of extension of intestinal catarrh to the substance of the intestine from its mucous membrane, and its occurrence is favoured by the mechanical obstruction to the return of blood from the chylopoietic viscera, by a chronically congested liver. This enteritis is not a sthenic form of inflammation accompanied by the exudation of lymph, nor does it usually excite the overlying peritoneum to effusive inflammation.

The bowel usually found pale, thinned and anæmic from malarial-atrophy, is, when enteritic, found darkly congested, thickened and its mucous membrane soft, and vividly injected. The peritoneal side of the bowel is also red and injected. Long tracts of the bowel are not affected in this intense manner, but only patches of a foot or two. The spaces between these present all the signs of chronic congestion or of incipient inflammation with signs of vascular dilatation and blood stasis. The congestion is usually most marked about the ileum. There is no trace of any ulceration of Peyer's patches or of the mucous membrane. A case which recently died at the Umballa Hospital of this affection had grass-green motions, just like a child with irritative diarrhœa. The colour of the diarrhœa is mostly either pale or dark. I have not often seen it green in adults.

The general *condition of the addominal organs of a malarial patient resembles to some extent that of an animal which has had its splanchnics cut.* In both cases the abdominal viscera become surcharged with blood. After splanchnic section however the congestion is active, and there may be a paralytic secretion of digestive juices. Electric stimulation of the splanchnic area and tight bandaging of the abdomen temporarily correct this condition, when experimentally induced, the former by contracting the arterioles and the latter by mechanically preventing passive congestion.

The adoption of electrical stimulation and tight bandaging of the abdominal organs are found clinically to be very effectual, even though the congestion differs in this case in being partly passive, partly mechanical and venous, and in being accompanied by an atonic lack of secretion instead of by a paralytic flow.

Hot salt baths of a temperature of from about 104°F. of half an hour's duration are also useful in remedying this condition, by withdrawing the blood to the skin, and so giving the internal organs a temporary respite.

Already I have alluded to the occurrence of *thinning and wasting of the small intestine* under the influence of constitutional malaria. This is often accompanied by patchy pigmentary degeneration of the intestinal mucous membrane. The coats of the gut become in advanced cases as thin as a sheet of paper.

Malarial degeneration or atrophy of the heart also occurs in advanced cases. This organ is found pale, thin, small and flabby. The ventricular walls are reduced to about half their normal thickness. The muscular tissue is atrophied and fattily degenerated. Such patients have a poor circulation ; they feel cold greatly, are subject to headaches, giddiness, loss of memory, noises in the ears, nausea, faintness and dyspnœa. They have a feeble hold on life. I have seen two of them die from an ordinary dose of Epsom salts and many die from exposure to cold.

Malarial Paralysis.—Severe and long continued malarial fevers often produce paresis or paralysis motor or sensory of both of the lower limbs. This was found to be due to *spinal pachymeningitis* in one case in which an autopsy was obtained: there was no history or signs of previous syphilis in the case. In the last two months I have seen twelve cases of paralysis of the lower limbs due to malarial fever. In one case compression myelitis had occurred; there was complete loss of control over the sphincters with complete motor and sensory paralysis of the lower limbs. The patient, a girl of 13, sank and died of exhaustion and bedsores.

C.—We next come to the question of *how the above conditions may be ameliorated, removed or prevented by alkaline saline mineral waters.*

Of these the chief are those of Neuenahr, Carlsbad and Marienbad. The first is very mild and is suitable for the weakest and most debilitated cases. The last, Marienbad, is the strongest and is suitable for powerful robust cases only. Carlsbad occupies an intermediate position, and is on the whole the most generally suitable of all three.

The composition of all three is practically similar, but their strengths differ as indicated above. The composition of Carlsbad water here given will serve to give a sufficiently definite idea of their nature.

The Carlsbad water contains in every pint 53 grains of solids. These solids are a mixture of the sulphate, carbonate and chloride of sodium. It also contains from 12 to 20 cubic inches per pint of carbon dioxide gas. When evaporated to dryness a crystalline residue is obtained, which, from its containing 55 per cent. of water of crystallisation, deliquesces in the tropics and is generally inconvenient and unmanageable.

This salt however by an ingenious process of dehydration and recarbonation is converted into a very stable and non-deliquescent, though hygroscopic, compound exported as the "*powdery Carlsbad Salt.*" In this form it is the most convenient and least expensive for use in the tropics.

The *pulverised or powdery Carlsbad Salt* (pulverförmig) consists of:—

Sodic sulphate	... 43·25
Sodic bicarbonate	... 36·29
Sodic chloride	... 16·81
Potassic sulphate	... 3·06
Lithium bicarbonate	... 0·39
Traces of others	... 0·20
Total	... 100·00

An artificial water made with this salt merely differs from the natural water in having its carbon dioxide gas in a state of combination, whilst in the natural water it is present in the free state. This slight defect can be remedied by adding a little soda water to the water in which you dissolve the salt.

The above analyses show that the main constituents of Carlsbad water are sodic sulphate, sodic carbonate and sodic chloride—a combination of sodium compounds. Even the aphorism of the older physicians—"ammonia for the lungs, potash for the kidneys, and soda for the liver"—shews us that we must expect the main action of this combination to be on the liver.

I shall nevertheless briefly review the therapeutic actions of these salts and point out their physiological uses.

1. *Sodic sulphate* ($Na_2\ SO_4\ 10\ H_2\ O$) is a saline hydragogue cathartic or purgative, which has a special action on the liver, stimulating it to increased action. It stimulates the coats of the stomach and intestines to pour out a thin watery secretion which may amount to diarrhœa when the doses are large. It thus carries away water from the blood vessels of the chylopoietic viscera, and relieves congestions of the liver and spleen by depleting the portal system indirectly. Magnesium sulphate acts in a similar way, but is devoid of the special action on the liver sodic sulphate has. Strong solutions of both these salts precipitate the globulin derivatives of blood and favour the coagulation of that fluid, so that it is extremely unlikely that either of them, in a mineral water, can have any effect in causing absorption of fibrinous exudations. Braun states that the effect of this salt on the intestines is mainly irritative, and that it is little absorbed. It decomposes in the alimentary canal in part into sulphuretted hydrogen which, acting on the small quantities of iron present in the Carlsbad water, is said to blacken the fæces and into sodic sulphide.

2. *Sodic carbonate* ($Na_2\ CO_3$, 10 $H_2\ O$) in the dilute form in which it exists in Carlsbad water is a diuretic and mild antacid. It emulsifies fats. On the presence in it of soda depends the alkalinity and fluidity of the blood. It exercises a solvent action on the albumen, fibrin and fibrin-factors of that fluid. A strong supposition exists that this solvent action of soda on fibrin is the normal method of change of substance (proteid) (Braun). Clinical experience shows that long-continued administration of this salt depresses, thins and weakens the patient. Excess of soda leads to excessive tissue and other changes. It can dissolve recent inflammatory fibrinous exudations. It is the principal salt in the pancreatic juice of man, and that on which its alkalinity depends. It is the alkali and chief inorganic constituent of bile and has a powerful solvent action on thickened bile and biliary concretions. When ingested *it dissolves off old and worn-out epithelium from the mucous membranes: hence its great use in catarrhal dyspepsia.* The inorganic basis of the fluid portion (serum) of the blood is soda, that of the solid portion (corpuscle) is potash. "Soda is the alkali, the presence of which is most important in the human system." Soda is the fluidifier of the blood."*

3. *Sodic chloride* ($NaCl.$)—In large doses is an emetic, a cholagogue and hydragogue purgative. In small doses it unquestionably supplies the stomach with material for the manufacture of gastric juice. It aids and stimulates the digestion not alone of nitrogenous

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* Macpherson's Baths and Wells of Europe.

but also of *starchy* foods. It excites rapid absorption and peristalsis. It is always present in constant proportion in the fluids and tissues of the human body, and is necessary in the former for the solution of their proteid constituents, more especially of the members of the globulin family. Wherever active cell formation is proceeding, there we find abundant sodic chloride, *e.g.*, in pus, synovia, grey hepatization of the lungs (Braun). In fluid exudations not accompanied by cell proliferation we also find it, as in ascitic fluid. With urea, that ultimate product of proteid metabolism, we find it associated so intimately, that many physiological chemists regard them as forming a definite chemical compound. The greater the amount of sodic chloride in the blood, the larger is the amount of urea excreted in the urine. Hence the use of this salt in cases of albuminuria where the excretion of urea is diminished. The quantity of salt in the blood is maintained at a constant strength, any excess being eliminated in the urine. The body retains no great reserve of salt as it does of glycogen. The osmosis and endosmosis between the blood and tissues is mainly dependent on the presence of sodic choride. Waters containing salt are therefore indicated (1) to stimulate and increase absorption and nutrition ; (2) to increase and complete elimination of effete matters (*i.e.*, proteid metabolism) : hence their great use in gout in which the metabolic changes instead of being conducted as far as the formation of urea, stop short at the stage of uric acid ; (3) to rouse the vital functions of the liver and stomach : hence salt is the great remedy for atonic dyspepsia (the dose to produce these effects varies from 60 grs. to 300 grs. daily in 60oz. of water) ; (4), in scrofulous enlargements of glands and scrofulous cachexiæ generally salt waters stand unrivalled. Such patients are, however, usually sent to more purely salt springs than Carlsbad, such as Homburg, Wiesbaden, Krenznach, Woodhall, &c.

Action of the Carlsbad water. 1, General.

1. *On the alimentary canal.*—The effect on the alimentary canal may be judged of from that of a bath of the Sprudel water on the skin. This it whitens, smooths, softens and rejuvenates, making it like that of a young child. The old intestinal epithelium is softened and gradually dissolved away exposing a newer and healthier layer beneath. A tongue whose owner has never seen it clean and free from thick fur for years is found clean and red, even in the morning. The sodic sulphate produces a slight though beneficial irritation and stimulation of the mucous membrane leading to a flow of water from the tissues, and is itself little absorbed, according to Braun. This relieves congestion of all the abdominal viscera, more especially of the liver and spleen, reducing them in size. It increases peristalsis, and gentle purgation follows.

2. *On the liver.*—Soda being the great biliary solvent, it eliminates old and thickened bile, and clears the minute bile ducts and vessels. Congestion is relieved. The patholcgical results of this are : increased functional activity, leading to secretion of bile of better quality and quantity, more perfect and complete digestion of nitrogenous foods (improved proteid metabolism) and removal of the tendency to formation of increased fibrous tissue. Even early deposits of fibrous tissue are said to be removed.

3. *On the mesenteric glands and lacteals.*—Old indurations and thickenings are softened, dissolved and removed—presumably by the sodic carbonate. This permits of free movement of the lymph and chyle. We thus often find that persons remarkable for spare and lean figures, after a Carlsbad course, fill out, become well nourished and plump. The functions of absorption and elimination are improved and invigorated. As a result the blood becomes purer and nutrition improves.

4. *Genito-urinary system.*—Urine is copiously evacuated, owing to the increased blood pressure caused by ingestion of the hot water. This carries away effete and harmful materials which had previously been lurking in the system. The urine voided is richer in epithelial *debris*, and this must be the result of a clearing of the lumen of the urinary tubules and passages. Congestive affections of the ovaries and uterus are relieved—menstruation, which was previously scanty or suppressed, making its appearance in normal amount. Recent inflammatory exudations around womb, ovaries and peritoneum are said to be dissolved. Those disordered constitutional conditions which lead to the formation of calculi in the kidneys and bladder are removed or ameliorated. The sexual appetite is reduced. For leucorrhœa and other female complaints the injection of the hot Sprudel or artificial water, after Emmet's method, produces the best results.

5. *The circulatory system* is stimulated by the warm water, but later on the power of the heart is slightly lowered by the depressing effect of the free alkali. This leads to slight giddiness, nausea, noises in the ears, faintness, slight loss of memory, drowsiness and the usual symptoms of a diminished supply of blood to the brain. The falling off in the heart's power may possibly also be due in part to the diminution in the peripheral resistance caused by the action of the waters in freeing out the portal circulation.

6. *The respiratory system.*—Breathing is always relieved by a diminution of portal congestion and removal of abdominal fat. It is slightly accelerated by drinking the hot water.

7. *Tegumentary system.*—As a result of impaired nutrition, the skin of malarial cases is often hard and dry, and the hair falls out. Carlsbad causes increased action of the skin by the action both of the water and baths—it grows soft and moist, and hair begins to grow again. Irritative skin diseases, such as eczema, are soothed and disappear. Scleroderma is also benefited.

8. *Nervous system.*—The alkali soothes the nervous system, calming it and diminishing reflex action. *Neuralgias*, being the "*prayer of a nerve for healthy blood*" as Romberg asserts, are often much relieved or cured by the blood purifying effect of the water. After the course is concluded, the operations of the intellect are rendered clearer and quicker owing to the blood

having been freed from the stupefying and yet irritating products of imperfect digestion previously circulating in it.

To concisely sum up: All the organs of the body concerned in the digestion of food, in the elimination of waste products and in the purification of the blood, are brought into a healthy state and do their work more efficiently, congestions are removed, and the results of recent inflammations dissipated.

Method of administering the water.—This description will be confined to the method of using the Carlsbad water.

Patients must be prepared to devote two hours each morning to drinking the water in the proper manner. On getting up in the morning a dose of 6½ ounces of the natural or artificial water made from the salts and warmed to a temperature of 120° F. should be *slowly* sipped as it cools down.

After this a walk of twenty minutes in the open air is taken, and then another 6½ ounce dose; a second walk of twenty minutes, and a third similar dose are next indulged in. This is followed by a walk of one hour, after which the patient can have a simple breakfast, consisting of 3 (Indian) eggs, soft boiled, about six ounces of *dry* toast and a cup of tea or cocoa.

A lunch of plain roast or boiled meat, a simple pudding or stewed fruit, may be given at 1 or 2 P.M.

A cup of afternoon tea at 5 P.M.

Dinner at 8 P.M. of fish, eggs, light pudding or stewed fruit. If the patient does not suffer from the headaches, neuralgia, melancholy and ill-temper of imperfect proteid metabolism, and if his liver is *not* enlarged, he might be allowed meat at dinner also. This course at Carlsbad or in Europe is kept up for at least twenty-one days. In India I have found it best to continue it eleven days at first, then stop it for from four to seven days, and again resume for ten days. It can be given in the hills all the year round, in the plains in the cold season.

The benefit derived from such a course is not experienced at once, but is manifested a month or two later by a vastly improved state of general health, vigour and digestion. Patients should be informed not to expect full benefit at once.

The course should not be taken during the hot weather in the plains for more than four or seven days.

The course should be started with water not heated above 80° F. *The colder the water the more aperient is its action.* It is desirable that its action should be aperient, more specially at the start. The object to be aimed at should be to regulate the dose and temperature of the water so as to produce one liquid motion daily, otherwise deleterious matters are re-absorbed into the system and give rise to headaches, pimples, &c., &c. *The hotter the water the greater its effect upon the blood and constitution.*

Some patients are given an extra dose of the water at 11 A.M. and another on going to bed at night. This latter has a great effect in cleaning the thickly furred "tropical tongue."

Diet.—During the course the amount of food taken is limited.

The following articles of diet are strictly excluded:—

Fresh fruit, salads, acids, cheese, tinned, dried or smoked fish, butter. Sweets, greasy dishes and strong wines or short drinks are also to be avoided.

Contra indications to the use of alkaline saline mineral waters:—

The presence of any of the following may be considered as contra-indicating the use of these waters:

1. Valvular disease of the heart.
2. Degenerative affections of the great blood vessels, *e.g.*, atheroma.
3. Advanced malarial degeneration of the heart.
4. Advanced Bright's disease.
5. Any disease of the brain, spinal cord or nervous system (chorea excepted).
6. Malignant tumours and degenerations.
7. Advanced syphilitic disease. A slight attack of syphilis, from which the patient has recovered, does not prohibit a subsequent course of Carlsbad.

Atony of the stomach is likely to be produced if the water is given too hot, for too long a period, or to very debilitated subjects. The signs of its onset are a failure of the good appetite which patients taking Carlsbad *properly* always develop, and heart-burn. The remedy for it is to stop the water for a few days and to give a teaspoonful of Homburg salts dissolved in a bottle of soda water every morning instead. When a Carlsbad patient's appetite fails, look out for some complication, such as atony or congestions. The latter are sometimes the result of taking the water too hot.

RADICAL CURE OF CHRONIC DYSENTERY IN ITS REPEATING FORM.

BY DR. HENRY GALLAY,

Surgeon-Major of the Colonies, Pondicherry.

GENTLEMEN,—I have the honor to lay before you a series of cases which I think, and trust, will be found to be of the highest interest to all medical officers and practitioners in India.

This succinct clinical statement of these cases, in fact, shows that it is possible, without much difficulty, by setting aside all the therapeutic substances which are to be absorbed by the stomach, and allowing the sick persons to feed themselves as they like, to cure old chronic dysentery, especially when this disease is assuming the form which is called *repeating form.* This result can be obtained simply by performing a daily and continuous series of washings of the large intestine with a solution, of which the following is the formula:—

Nitrate of silver crystallised	...	1 scruple.
Distilled water ...	...	1 litre.

CASE I.—Dr. G., a medical officer, in 1888, while residing in Tonquin, contracted acute dysentery.

During four years he had fourteen relapses of the same disease, in spite of all known suitable treatment, in spite of ten months milk-diet, between the sixth and the seventh relapses.

It was after the eleventh relapse that Dr. G., following Dr. Le Dantec's advice, felt inclined to try on his old and tenacious affection the washing of the large intestine with the above solution, which washings had already been successfully tried by his eminent friend and colleague against acute dysentery.

For several times, series of ten washings each showed at each time a period of apparent recovery, lasting from forty to fifty days; but with such an amelioration in the general state of health, such a feeling of relief from pains, that the intervals which formerly separated the crises, and which the patient used to call his periods of quiet, now seemed to him dreadfully unbearable. After the fourteenth relapse, Dr. G. decided to begin an indefinite series of washings.

This series of washings lasted thirty days, and were interrupted by Dr. G. having had to leave France. But since Dr. G. left Marseilles, the recovery, which he supposed to be not a complete and definite one, has not, however, until now, failed (August 1892.) Besides, from that day all precautions as to diet have been put aside, recovery being more and more confirmed (7th September 1894).

CASE II.—Mr. X., Revenue Officer at Saigon, was suffering for two years from dysentery in repeating form. He had tried every sort of treatment. Even in moments of quiet he suffers and passes mucus through the anus.

At Bordeaux, in June 1892, he underwent a series of twenty washings, and then wrote to me, saying that he has never been so well.

In reply, I advised him to repeat the series. Since I have left France I have never heard of him; but what I have learned from experience permits me to conclude that he did not require any more aid from me.

CASE III.—Miss D., fourteen years of age, an Indian Eurasian, had dysentery in April 1892 and was cured in fifteen days. But since she has suffered from constant uncontrollable stools in the morning, frequent indigestion which give rise to ejection of mucus and bloody matter with tenesmus of the anus, pains when the wind passes in the colon and sleeplessness.

September 1892.—A series of twenty washings completed amelioration. The series was kept up by way of precaution to the fiftieth washing.

September 1894.—The cure has been confirmed since.

CASE IV.—Mr. D., Colonial functionary, had contracted dysentery at Hue in May 1889.

Notwithstanding twice returning to France and the use of the waters of Bassang, he was always suffering and was subject every moment to relapses. He lost 24lbs. of his weight. In January 1893, he began a series of sixty washings—Result, complete amelioration. In July 1894, two years later, Mr. D. left Pondicherry always progressing and having regained his weight.

CASE V.—Miss X., eighteen years, Eurasian, had in 1891 dysentery at Hyderabad. Since then she has never passed two months without relapse.

In May 1891 a series of washings up to fifty only procured perfect amelioration. I heard of her a year later, the cure was maintained.

CASE VI.—Revd. Father P., missionary in Tanjore, contracted dysentery in 1890. Since then he has had constantly alternative constipation and mucous diarrhœa with tenesmus.

Series of sixty washings.—Complete cure. He has been able to resume his hard work, while he had scarcely any strength at that time, in 1892; and to-day, September 1894, he came to show himself to me; he was stout, fresh and vigorous.

CASE VII.—Mr. P., Controller of Revenue Accounts at Pondicherry, had acute dysentery in 1888. Since constant relapses. In July and August 1893 series of only fifty-six washings. Complete amelioration, which is confirmed now in September 1894.

CASE VIII.—Mrs. E., twenty-one years, Eurasian, had dysentery in repeating form since the age of fifteen years; greatly weakened; chlorotic and always suffering.

In October 1893, she began a series of fifty washings. Complete cure with ten washings.

In June 1894, she went away to Europe strong and fattened with an additional weight of 4lbs. and bearing without difficulty the commencement of pregnancy.

I have, of my own account, shortened the clinical description of the above cases, the details being the same for each of them.

Considered, on the whole, they show the reader that, by means of sixty washings with nitrate of silver solution, I have succeeded in curing myself from a repeating dysentery which persisted for four years, and that, emboldened by this personal example, I have also succeeded in curing seven other patients of dysentery from one to five years standing.

I must now indicate the way of proceeding methodically with the antiseptic washings of the large intestine. This method is very important, and the final success or failure depends exclusively on its good and rational application.

Use of method.—The process I make use of is the same as that indicated some time ago (September 1890), by Dr. Le Dantec, in *Archives de Medecine Navale* against acute dysentery.

The patient should lie down on the right side of his body, his left thigh being bent; in short he will occupy the same position as if a digital exploration of the rectum were to take place.

Keeping this position, a first enema of tepid water destined to empty out, wash and clean as completely as possible the large intestine is given.

After evacuating this first washing of cleanliness, the patient assumes again the same position as before, and then the antiseptic washing is applied:—

Nitrate of silver crystallised... ...	1 scruple.
Distilled water	1 litre.
Laudanum	20 to 30 drops.

which he tries to keep in for five minutes.

It is proved by numerous experiments made on dead bodies that to fully ensure the washing of the colon up to the cœcum, one litre at least of liquid is indispensable, when the experiment is made on adult corpses, but on the corpses of children four or five hundred grammes are enough.

In order that the solution may be kept in by the large intestine for some minutes, it is necessary to make use of a rather long clyster-pipe and to get it pretty deeply thrust in, so as to pour the liquid into the very cavity of the rectum and thus not rouse too quickly the sensibility of the ani-sphincter muscle.

The pressure of an Eguisier's syringe is sufficient to push on the liquid up to the cœcum. It must be quickly done, for the instrument made of silver may cause a change in the nitrate salt if delay occurs.

An ordinary enema India-rubber syringe may also be employed, but sometimes its jerking ejaculation provokes the muscular contraction of the large intestine and often becomes inconvenient for the retention of liquids.

The best apparatus is an ordinary glass funnel, the slender portion of which is adapted to a rubber pipe about two and a half yards long. A forceps squeezing the pipe allows the recipient to be filled up. An assistant then lifts the funnel up in order to give the liquid a sufficient pressure, while the patient himself holds the clyster-pipe in a suitable position.

An enamelled iron recipient fixed to the wall or to a partition is even better than the above described apparatus, for the patient is able to operate himself without any assistance.

The silver nitrate solution, after staying for a few minutes in the colon, will be evacuated, sometimes in one effort, sometimes in two, the second evacuation being separated from the first by a few hours interval.

The only ordinary immediate consequence of the washing is a sensation of stricture at the lower part of the rectum. But this sensation, after a quarter of an hour at most, passes away.

Sometimes, but rarely, except in some very impressionable patients, the washing is followed by fits of stomach cramp.

These cramps seem to be nothing but muscular contraction in the coats of the transverse colon. These cramps are besides of short duration and mastered by simply staying in bed.

This is the reason why I always advise the patients to apply their washing in the morning, as soon as they awake, as, if they feel any cramps, they can find again at once the useful and pleasant warmth of the bed they have just left, and after an hour's rest they will do well for the rest of the day.

Out of seventy washings which I underwent, I have only three times felt the above mentioned cramps. At any rate, this slight inconvenience did not prevent a young boy of fourteen and a young girl of eighteen years from bearing the treatment up to the end (Cases III and V.)

Result.—Often, from the first washing, the amelioration is complete. One can, at any rate, rely on the third or fourth washing.

The patient suffers no more, sleeps, goes to the stool once or twice a day ; the painful gas and hard gripes are over. It is the sign of recovery.

This sign is more perfect when at the fifth or the tenth washing I allow the patients to lay aside all precautions regarding diet, and he who for several months has suffered from hunger will certainly understand that I consider this point as one of the greatest advantages of the treatment I am now recommending. The patient is already stronger and alert, is henceforth living like any one else. He must not however be left to himself. Four times I have myself noticed the insufficiency of a too short series of washings. However great may be the antiseptic power of nitrate of silver, it does not cure in a few days an affection so inveterate as chronic dysentery.

Whether it is because the microbian agglomerations infiltrate the deep coats of the intestine, and are thus sheltered from the first attacks of the antiseptic salt, or because the antiseptic itself coagulating the albuminoid substances on the surface of the ulcerations shelters the deeply hidden microbes, or on account of the persistence of the spores, or simply because the ulcerations, even when freed from the microbes which keep them in bad order, cannot be cicatrized in three days and thus remain quite ready for a new sowing from the ordinary inhabitants of the large intestine, be that as it may, repeating dysentery requires continuous attention. The treatment must be pursued for a sufficiently long time so that the newest spores may have enough time for hatching, or the last ulceration time for becoming cicatrized.

I have, by a groping process, been enabled to verify on my own intestine how very insufficient is a too shortened series of washings.

Duration of the treatment.—Since then, therefore, I have always recommended to continue till the sixtieth washing, and that has on every occasion been enough.

Two of my patients, owing to removal, have been obliged to cease at the fiftieth washing ; however in fifteen and eighteen months they have not relapsed.

But, in this case, it is always better to apply more than enough, and when definite recovery is the certain result, what trouble is it for an already morally cured patient who has recovered his appetite, plumpness and strength, to persevere for a few days more in the precautions which he is already accustomed to ?

Sixty washings have always been enough even for dysentery of four or five years standing.

I do not however reject the possibility of seeing the disease return, even after this period had expired, and in such a condition, I would see no inconvenience in doubling the duration of the treatment. I am, moreover, sure that the patient will raise no objection to my prescription.

The first trial, even when not attended with success, will have given him faith in the washings ; his general state of health will have been so much altered for the better, his well-being so different from his best moments of the time past, that he will be the first to have recourse to the treatment which has already relieved him.

I went through the same state of mind before finding this remedy which I did not much rely on. And I must confess that I had arrived at the point of considering my affection as a permanent infirmity and the prospect of definitely undergoing a daily or bi-weekly washing as a very desirable result, since, by doing so, I was able to enjoy all advantages of health.

It is chiefly with this idea that I undertook the long series, which has been interrupted only by my departure to India.

My full recovery since my departure from Marseilles has been an unexpected result and remains the example I can always offer to chronic sufferers, who are more or less disheartened and sceptical regarding new modes of treatment.

He who has followed my example has never been deceived, and it is guided by a hope of being profitable to a large number of suffering people that I have made this attempt to inform colonial medical men of the results I have obtained in so tenacious an affection as repeating dysentery by a method of treatment, which, in my hands, has shown itself as easily bearable as quickly effective.

THE ANTISEPTIC TREATMENT OF DIARRHŒA.

BY P. CARR-WHITE, M.B., I.M.S.,
Staff Surgeon, Bangalore.

The author gave an account of a number of cases, all Europeans, which he had met with at Bangalore during the last two years.

He considered that many cases of simple and tropical diarrhœa (as there met with) might be due to a septic condition of the intestinal canal; and that the bacterium coli commune might cause it by taking on a harmful action when the intestinal vitality was lowered by the effect of chills, errors in diet, dyspepsia or constipation.

The form of diarrhœa usually met with in Bangalore was that in which the patient passed three or four motions in the morning, pultaceous in consistence, light brown in colour, and very offensive. After this had persisted for some time, the motions became more fluid, and tended to occur throughout the day. No griping as a rule was present, but flatulence was always a marked symptom. On palpation, a few slightly tender spots were sometimes found usually in the neighbourhood of the umbilicus, but sometimes over the large gut.

For this disease Dr. Carr-White, considering that astringents only aggravate the disease, had found that salol had almost a specific effect. He gave ten grains thrice daily, and said that cases so treated do not require a rigid milk diet, but do well if they only eat easily digested food, such as fish, chicken, eggs and milk puddings.

He added that he had not had any opportunity of examining the stools microscopically. All his cases were amongst Europeans.

NOTE ON THE SYMPTOMS OF FILARIA MEDINENSIS.

BY J. DUKE, M.D.,
Surgeon-Lieut.-Colonel, I. M. S.

The following note on the symptoms of guinea worm (*Filaria medinensis*) is the outcome of considerable practice. My personal experience is confined to Central India. The initial and premonitory sign of guinea worm is *Urticaria.* I allude to a rash that attacks the whole body. This rash shows itself in two forms: One a small papular eruption (lichen), rather like mosquito bites; the other, large raised blebs, and wheals (pomphi), big nettle rash. Careful enquiry will show that rash to be present in, I believe, 80 per cent. of such cases. It is, therefore, a constitutional symptom of great importance, and experience proves its diagnostic value.

In a few cases only the small variety may be present about the neck and face. This should be carefully ascertained, as I have seen very serious and dangerous symptoms follow.

In a few cases only local irritation is observed, while in very few no irritative symptoms may be complained of. I draw attention to this symptom, because little mention is made of it in ordinary text books. This general eruption lasts from two, three, four to twenty-four hours. Associated with it is vomiting, frequently only once; occasionally excessive. The rash is generally followed by a vesicle which denotes the site of the parasite. This vesicle sometimes shows itself an hour afterwards; frequently several hours, but often a week, weeks, or even months, may elapse.

I quote in support one or two specimen cases :—

Case A.—At 2 P.M. a sepoy in Hospital, attending another comrade suffering from guinea worm, was suddenly attacked with acute urticaria, large wheals. This rash lasted from 2 P.M. to 5-30 P.M. It was attended with burning pain in stomach, vomiting twice. Four hours after a bleb appeared over the outer ankle, and a guinea worm followed in due course.

This is an ordinary *typical case.*

Case B.—Is instructive and rare. At 1 A.M. a fine looking sepoy went outside his house to pass water. He fell down and became unconscious. He soon became deeply insensible, almost pulseless and had stertorous breathing.

After an hour consciousness partially returned and he complained of severe burning in the stomach. In two hours he was in a state of semi-stupor and vomited three times; he was also purged twice. At 8-30 A.M., seven and a half hours after, he had a dreamy staring look, like a man recovering from a fit. His pulse was slow and hardly perceptible. The irritation of the stomach was excessive and the retching most violent and noisy, disturbing the whole ward. His case was serious and puzzled me. The diagnosis was "possibly round worms in the stomach." Counter-irritation, cocaine, &c., failed to relieve his symptoms. At 4 P.M. calomel 2 grains and santonine 5 grains were given but vomited. At 5 P.M. a second dose was retained. At 10 P.M. a third dose was given; vomiting now ceased and the pulse improved.

The next day his pulse and expression were sound, santonine having failed to expel round worms, and it having been elicited that a small rash had shown itself for a short time on the neck during the previous day, the diagnosis was changed to *guinea worm.* Three days after, a swelling showed itself over the right heel, and, after a further period of five days, a free incision let out a quantity of pus, and a *guinea worm*, strong, vigorous and moving like a snake.

Case C.—Sepoy had *urticaria* for three hours, followed by heat and swelling of knee joint. Guinea worm diagnosed. Santonine 5 grains given on four days. The joint effusion was absorbed and the patient discharged to duty, still I believed my diagnosis was right. Forty-three days after, this patient was readmitted with four guniea worms ; three below the left knee, one at right ankle. Such cases are not uncommon.

Case D.—Adult admitted November 26th, 1894, Victoria Hospital, with enormous swelling of leg and threatening gangrene below knee, knee-joint greatly distended, with marked fluctuation up to apex of scarpas triangle. The case was very serious and the patient could give no explanation. I considered it one of acute suppuration of knee, extending up thigh and pressing on the femoral vein, thus causing the enormous œdema. Under chloroform the knee joint was laid open by a curved incision on its outer side. After a pint of pus had escaped, a large guinea worm appeared. This parasite in the knee joint was the cause of this serious mischief. When a guinea worm is seen under the skin it should be cut down on immediately and removed entire. Regarding the length of this filaria, my limit is 32 inches. The average is 20 to 30 inches in Central India measured fresh on removal from the body. If placed in water it absorbs that fluid, and its length is thereby much increased.

Treatment.—Free and very early incisions are required, in all cases of swelling and inflammation. Probably the *most recent* is the best. This* treatment consists in the subcutaneous injection into three or four places around the circumference of the bleb, or spot whence the worm issues, of a solution of hydrargyri bichloride strength 1 in 1,000.

A syringe full, holding 30 minims, is generally injected into three places.

This treatment is carried out every second day for two occasions.

Pain and swelling follow lasting for several days. The exuding portion of the worm dries up, and the symptoms disappear at varying intervals.

MYCETOMA.

BY J. E. BOCARRO, L.M. & S., BO.,
Assistant Surgeon.

Of the diseases common to India, mycetoma may be regarded as one deserving of some attention, inasmuch as it offers to microscopists and pathalogists a very interesting field for research ; and, accepting the disease as being of fungoid origin, as recent discoveries have shown it to be, it further opens out an avenue for investigation into the natural history of the fungi (for there exist at least two of them), their preventive treatment, and a host of other important considerations, all which, up to the present day, lie on the background of obscurity.

The scientific history of mycetoma, or Madura disease, dates from the year 1874, when Dr. H. Vandyke Carter published his invaluable monograph on the subject, and promulgated, for the first time, the view of the parasitic nature of the disease—an entophyte belonging to the vegetable kingdom being, it was said, the offending agent.

Dr. Carter's investigations led to the conclusion that both forms of the disease, the black and the pale, or, as Dr. Carter named them, the *melanoid* and *ochroid* varieties, resulted from the infection of one and the same parasite—the *Chionyphe carteri*, the pale form, it was asserted, being only a defaced state of development of the black. Drs. Lewis and Cunningham admitted the fungoid nature of the black particles, but were disposed to look upon them as accidental growths and not in any way connected with the production or causation of the disease : the fungal nature of the roe-like particles in the white variety they denied *in toto*, regarding them merely as metamorphosed fat.

From recent investigations conducted in Europe, the parasitic nature of the disease, as first discovered by Dr. Carter, is, however, now generally admitted. Bassini, in 1888, pointed out the mycelial nature of the tumour in a case of the black variety found in Italy, the first case, it seems, known in Europe. Dr. Kanthack, in 1892, had likewise shown the disease to be of fungal origin, and has since tried to identify it (the white variety at all events) with actinomycosis. More recently, in 1893, Drs. Boyce and Surveyor have demonstrated both forms of this disease as being essentially fungoid growths, and more than that they have been able to indicate differences under the microscope existing between the fungi of the two varieties of the disease.* They say : "We, on the other hand, will bring forward reasons for believing that there are at least two distinct fungi, one a very highly organised species, the other a very delicate and lowly organised type, presenting very many of the characters of actinomyces." And they further add that, while some of the leading features of the roe-like particles favour a relationship with actinomyces, from others they cannot, in their present state of knowledge, draw any conclusions.

In the course of the past year Professor Boyce forwarded to the Civil Hospital, Hyderabad, Sindh, a number of Glycerine-Agar tubes for inoculation, and these Dr. Keith (late Civil Surgeon, Hyderabad, Sindh) and I inoculated with particles from fresh specimens of both the black and white varieties. Of these inoculations, Drs. Boyce and Surveyor write that they have not yet been able to cultivate the black fungus, but that in the case of the white variety they have met with success, and the exhibits before you, gentlemen, marked A and B (the two sealed test tubes) contain the cultivated streptothrix from the white variety of mycetoma, which, it will be seen, resembles very closely the streptothrix of actinomyces. Drs. Boyce and Surveyor are, at present, working out the morphology and characters of this white pure culture. I have also here placed for your inspection microscopical and pathological specimens and a few photographs of the two varieties of fungoid growths. The microscopical specimens and the two test tubes have been obtained from the Pathological Laboratory of University College, London, and I, here, with pleasure and deep gratitude, beg to express my indebtedness to Prof. Boyce and Dr. Surveyor for having so very kindly favoured me with them. The pathological specimens and the photographs are my own collections from cases that have appeared in the Civil Hospital, Hyderabad, Sindh.

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* British Medical Journal, June 7th, 1894. By Dr. Emily.

* *Note.*—A detailed report of their method of investigation and its results may be read in the Philosophical Transactions of the Royal Society of London, Vol. 185 (1894) B., pp. 1-14, in a paper entitled "Upon the existence of more than one fungus in Madura Disease (Mycetoma)."

In the face of the evidence that the pale particle has been successfully grown by artificial cultivation outside the human body doubts should no longer be entertained that this fungus is the cause of the white variety of the disease; but Prof. Boyce gives further proofs of the fact by the success he has met with in his experiments to reproduce the disease in animals. Subcutaneous inoculation of rabbits, guinea-pigs, monkeys, and rats, with the artificial culture above referred to, gives rise, it would appear, to a local re-action, without any general infection of the system, and following the re-action the production of a tumour of slow growth, which, on section, is found to bear the characters of the original inoculated matter. I may add that, in my hands, direct inoculation of rabbits and dogs with fresh particles from either variety has hitherto proved a failure.

Bearing in mind the knowledge, as described above, of the microscopy and macroscopy of the disease, I set myself to observe how far clinical history bore out the two important points connected with the disease, firstly, the fungal origin of either forms of the disease, and, secondly, the fact that they were probably due to two distinct forms of mycelial growths, as Drs. Boyce and Surveyor have indicated.

With regard to the former consideration—the fungal origin of the disease—the fact that the disease begins *ab externo* has an important bearing. Clinical observations * made by me in the Civil Hospital at Hyderabad, Sindh, and reported in the *Indian Medical Record* under date June 1st, 1894, help to establish this conclusion. All cases of early growths have been cases of superficial growths. Dissection of the growth during operation, or sections of the diseased part after excision or amputation, afford evidence of the disease beginning generally in the loose cellular tissue, often in the subcutaneons cellular tissue, thence subsequently extending along muscular and tendinous sheaths to the other soft structures, and finally invading the hard structures.

The observations apply, in all respects, to both forms of the disease, the black and the pale, and these facts, coupled with certain clinical points as detailed below in the general history of the cases, all incline towards the conclusion that, not only is there a definite local agent or agents at work which causes the disease, but also that such local agent or agents starts its destructive process from a superficial site.

The clinical points are as follows:—

(*a*) *The cause assigned, viz.*, wounds, sores, the prick of thorns, &c. The *babul* (Acacia arabica) thorn is frequently mentioned as the primary source of irritation, and I have myself many times detected the points of these thorns imbedded in the tumour.

(*b*) *The occupation of the patient*, the disease being common among tillers of the soil, or among those who have some time or other of their lives exposed themselves to influences such as commonly surround people of the agricultural class, *e.g.*, boatmen, shepherds, pedlers, potters, &c.

(*c*) *The common seat of the disease*, the feet and hands being generally affected, the former far more than the latter. In over 90 per cent. of the cases observed in the Civil Hospital, Hyderabad, Sindh, these were the common situations, the exceptions being a case of the black variety occurring in the right scapulo-vertebral interspace, another near the right sacro-iliac joint, one in the left leg, and one over the right knee.

(*d*) Lastly, and above all, the fact that the disease could be completely eradicated by excision of the superficial growth.

As regards the second consideration—whether the two varieties are simply transitional stages of one and the same fungus, as Dr. Carter holds, or, whether the two forms are perfectly independent of each other in their morphological nature, as Drs. Boyce and Surveyor have pointed out—I beg to adduce the following clinical points in evidence of the latter view.

They are, briefly, as follows:—

(1.) The general historical data for either variety are the same, with this important difference that in all cases, without exception, patients have, with reference to both forms of the disease, distinctly stated that from the very earliest indication of the existence of the growth, when one or more mamillated excrescences appeared upon the surface and burst, the sinuses so formed gave exit, throughout the rest of the course of the disease, either to pale or to black particles, but never to both kinds at the same time, or to one kind first, and, at a later date, to another.

(2.) As to the idea of the defacement of the fungus, while one would naturally expect a period of stasis in the growth of the tumour, there was, on the contrary, following the periodical extrusion of particles, observed a more or less gradual increase in its size, and in no instance was there noted, at any time, limitation or retrogression of growth.

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* *Lancet*, September 1893.

(3.) Sections and cross-sections have not, at least in my experience, shown any admixture of the two kinds of fungoid particles in one and the same specimen; on the other hand, there was a curious completeness manifest in the anatomical characters of each individual variety.

(4.) In the dissection of infiltrated parts, on following up the advancing course of the disease along tendons, fasciæ, and areolar tissue to its termination, where, it must be admitted, the disease is to be found in its earliest stage of development, there is invariably discovered pale particles in the pale kind, and black particles in the black kind, and so far as the naked-eye appearance goes, no transitional stages of growth from one to the other.

(5.) Careful excision of these terminal sites of the disease effectually cuts off all chances of recurrence; if not the disease tends to relapse, in which case the pale is followed by the pale, and the black by the black form of growth. Five secondary and in one case a tertiary relapse of this kind have been observed by me in the Civil Hospital, Hyderabad, Sindh.

With regard to statistics on the subject, I beg to refer you, gentlemen, to my table of 100 cases of the disease treated in the Civil Hospital, Hyderabad, Sindh, from March 1883 to March 1893, and published in the *Indian Medical Record*, August 1893. Since March 1893 up to 1st October last, I have operated upon 31 cases, 16 from April to December 1893, of which 14 were of the *black* kind and 2 of the *white*, and 15 from January to October 1894, of which 8 were of the *black* and 7 of the *white* variety. Thus, there have occurred in 18 months a total of 31 cases of the disease, of which 22 were of the black and 9 of the white fungus. As regards *sex*, of these 31 cases, 27 were males and 4 females (all wives of cultivators); and as to *caste*, 25 of them were Mahomedans and 6 Hindus. The disproportion in caste may be explained by the fact that the greater part of the rural population in Sindh is Mahomedan.

A CASE OF LYMPHADENOMA (HODGKIN'S DISEASE) IN A NATIVE.

BY J. CHAYTOR WHITE, M.D.,
Surgeon-Captain, I. M. S.

THE comparative rarity of this disease in the native of India is my apology for bringing this case before the Congress, and I venture to think that some of the clinical features will be not altogether devoid of interest. Chevers, during a long experience of India, says: "I only saw two genuine cases of Hodgkin's disease, one in a European and another in a native gentleman of high rank, in whom it proved rapidly fatal. In August 1880, Assistant Surgeon K. C. Bannerjee brought before the Calcutta Medical Society an imperfectly detailed case of a Mahomedan, aged 30, who died with an enormous amount of glandular disease after about 22 months' suffering. Death appears to have been caused by erosion of the vertebræ by a matted mass of mesenteric and retroperitoneal glands." I have met with the disease, both at home and on the Continent, fairly frequently, and very full and complete accounts of its obscure pathology have been given by Gowers, Wilks, and Taylor in England, and by Verchow and Wunderlich in Germany. The case I wish now to bring to your notice is that of a man, Mir Baksh, aged 36, a native of this district, who was admitted into the Mozuffarnagar Dispensary on July 19th, 1894, suffering from a series of multiple enlargements of all the superficial lymphatic glands of the body. He first noticed a swelling in his armpits a year ago, and in the following October the inguinal glands on both sides became affected. About three weeks ago he noticed swellings under the jaw and around the neck, when deglutition became difficult and his health bad. He had not suffered from syphilis, nor had any of his relatives ever been similarly affected. His general surroundings were malarial and his food bad; he was emaciated, anæmic and weak. Gowers points out that peripheral irritation, such as a bad tooth, or a discharge from the ear, is not unfrequently the cause of the first glandular enlargement. This man had for years suffered from granular lids, but I hardly think there is sufficient reason for supposing that in this case the condition of the lids had anything to do with the starting of the general disease.

On examination it was evident that the hæmopoetic system was the primary seat of the morbid change; every palpable group of lymphatic glands was affected. The cervical chains were all enlarged, but had not become aggregated. The sub-maxillary, sub-lingual, and parotids of both sides were greatly enlarged and conglomerate. The adenoid tissue of the pharynx and fauces was involved, and the tonsils when palpated felt like almonds. The voice was hoarse, and there was difficulty in deglutition, but the recurrent laryngeal was not paralysed by pressure. The thyroid was much enlarged, and the mediastinal glands were also manifestly involved. The mesenteric glands were easily felt on palpation, and from the enlarged retroperitoneal and lumbar glands of the left side there was a copious discharge of lymph, which found exit at the bottom of the abdomen above Poupart's ligament. There was no evidence of change in the thymus, nor was there any caseation or suppuration in any one of the enlarged glands. The spleen was considerably increased in size, smooth on the surface, and could be felt well below the ribs. There was slight ascites and swelling of both extremities. Both lungs were affected and sub-pleural and mediastinal lymphomata were probably present.

At the right base there was friction, algophony and all the physical signs of pleurisy. The upper lobe was tympanitic, while over the surface of both lungs posteriorily were scattered patches of consolidation, no doubt subpleural glandular enlargements from invasion of the lung substance by the disease.

The expiratory murmur was prolonged; increased local resonance with bronchial breathing and subcrepitant rales was heard at various positions scattered over the lungs. The organs presented almost every variety of physical sign, and there was no doubt that metastatic deposits were present in the lung substance. The cough was brassy and there was a slight dirty expectoration. There was slight precordial dulness extending over to the right side of the sternum and there was a presystolic murmur and accentuation of the second sound at the base of the heart. The pulse was frequent 106, soft and compressable and equal on both sides. The patient had not had epistaxis, nor, as far as I could see, were there any petechæ or subserous hæmorrhages.

There was a dull apathetic look about the man's face, and his color more nearly approached a light chocolate brown than any other hue. His urine was normal. The blood, on examination, was found to be distinctly deficient in red cells, there being only about 53 per cent of the normal. Leukæmia was marked, there being an excess of white cells in a proportion of about 1 white to 75 red. The red cells were also poor in hæmoglobin, it being estimated at about 45 per cent. of the normal. On staining a specimen after Ehrlich's method with eosine and logwood, the eosinophile corpuscle was not found present. This cell was first noticed by Ehrlich and afterwards by Müller, and was supposed to be pathognomonic of lymphadenoma It is probably in this case an altered cell element of the new growth. It differs from the ordinary leucocyte in being larger and commonly contains more than one nucleus. It is readily stained by eosine and hæmatoxylin, and though usually present in Hodgkin's disease is not invariably so. It is found abundantly in ordinary splenic leucocythemia, but is of doubtful diagnostic value, as was pointed out by Kanthack (B. M. J. 16. 7. 92 p. 120) and by Neusser, Leyden and Janowski, who found large numbers of these cells in gonorrhœal pus. Kanthack also found them in phthisis and in abscesses, and he considers their presence or absence of no diagnostic value in distinguishing Hodgkin's disease from ordinary leukæmia.

The temperature throughout the case under notice was of the curiously characterstic hectic type. It never exceeded 102 and never quite touched the normal curve. No febrifuges were administered for its control. Arsenic was exhibited in large doses: iron, turpentine, stimulants and a nourishing diet were also prescribed. I gave thyroid gland tabloids a trial but with absolutely negative results, and as far as I can see a fatal ending will inevitably ensue, probably within the next few months.

From enquiries I have made, I learn that the disease in the North-West Provinces is very rare. It is the first case I have met with in this country, and I should be glad to know if it is equally rare over the rest of India.

SOME CLINICAL ASPECTS OF THE COAGULABILITY OF THE BLOOD.

BY L. ROGERS, M.B., B.S., F.R.C.S.,

Surgeon-Lieutenant, I. M. S.

In venturing to read before you a few remarks on some clinical applications of Dr. Wright's method of estimating the coagulability of the blood, I must crave your kind indulgence, as much of it has been prepared whilst on the line of march. In fact, it is only because I believe my subject to have an important practical bearing on many pathological processes of every-day occurrence that I am bringing it to your notice to-day.

The method introduced by Dr. Wright of Netley is a very simple one. It consists in pricking the finger tip as in the use of Gower's hæmocytometer and drawing up a small quantity of blood into a fine tube of uniform calibre. From four to six tubes are filled at noted intervals, half a minute between each being a convenient time. By blowing down these at given intervals the shortest time in which the blood is found to be clotted so that it cannot be blown out of the tube will be the coagulation time. With a little practice it can be determined to within 15 or even 5 seconds. The normal time of a healthy person is usually between 2½ and 5 minutes, and varies slightly with the temperature and the time of day especially in relation to meals, being shorter after a full meal and longer after a fast—an important point which I shall refer to again presently. My own time has been recently very constantly between 2min. 15sec. and 2min 20sec. I pass on to the consideration of the methods of increasing and decreasing the coagulation of the intravascular blood, most of which have been recently studied by means of this instrument. The late Dr. Wooldridge, whose work threw so much light on the vexed question of coagulation, found that extracts of the thymus thyroid and other glands contained substances which he called tissue fibrinogens, and which, when injected into the carotid artery of a dog, produced in small quantities clotting in the portal vein, followed by hæmorrhagic impacts, and in larger quantities instantaneous clotting of all the blood in the body. This is by far the most powerful accelerator of intravascular clotting. He also found that when partial clotting was produced in the body, the remainder of the blood of the animal remained fluid after its removal from the body. This he describes as the negative phase of coagulation.

I now come to the clinically more important substance, calcium chloride. This salt is very important in, if not essential to, the process of clotting as Dr. Wright holds it to be. It is present in normal blood and in Wooldridge's tissue fibrinogens in small quantities. If it is precipitated from blood by the addition of sodium citrate, such blood will remain indefinitely liquid. Its action when added to the blood of accelerating coagulation can be demonstrated either by mixing them in a fine tube containing a mixing chamber or by estimating the coagulability of the blood both before and after taking it internally. As the latter is the more satisfactory method, I shall refer to it only in relation to this and other drugs. As a typical experiment, I may quote one I did at Netley in 1893. After finding my coagulation time to be $5\frac{1}{4}$min. I took 15 grains of calcium chloride at 7 P.M., and again at 7 A.M. the next morning. At 3-30 P.M., the same time of the day as the previous estimation, my coagulation time was only $1\frac{3}{4}$ minutes; the day after it was $3\frac{1}{2}$, and on the fourth day it had got back to $5\frac{1}{4}$min. again. It might be thought that in the case of anyone whose natural time was a short one and $1\frac{1}{2}$min. has been observed that large or frequently repeated doses of this drug might cause a dangerous increase of coagulability. This however is not the case, as, if the drug is pushed after a temporary increase, the coagulability lessens, until it is even lower than normal. This is, I think, analogous to the negative phase of coagulation mentioned above.

Another very important and clinically useful method of increasing the intravascular coagulability is by the inhalation of CO_2 gas, preferable by a Kipp's apparatus, or in default from a jug or inhaler filled with chalk and hydrochloric acid. Professor Wright who worked out this method has recently administered the gas from an India-rubber bag by a Clover's inhaler, by means of which it can be diluted with any desirable amount of air. By this means an even well marked increase of coagulability can be produced than by giving $CaCl_2$. For instance, in the case of a hæmophilic child in whom the coagulation time had been accelerated from between 45mins. and 1 hour up to 2min. 35sec., by taking $CaCl_2$, which latter time was not hastened by the addition of this salt to the extravascular blood shewing the beneficial action of the drug had reached its limit, the administration of CO_2 gas further quickened it to 1min. 40sec.

These are the more important of the coagulation-accelerators. During the last two months I have been investigating the action of various drugs, more especially those usually considered to have hæmostatic properties on coagulation. Although I have not concluded my experiments, I may mention a few results that I have obtained by estimating the coagulation time both before and after taking them. Thus, my time being 3min. 25sec. at 8 A.M., I took half a drachm of turpentine at 10-45 A.M. At 1-45 P.M., that is, three hours later, it was 2min. 45sec., and at 3-45 P.M. was 2min. 50sec., an acceleration of 40secs having been produced. The next morning it was again normal, namely, 3min. 20sec. Gallic acid in two 20-grain doses produced no effect. Ergotine gr. 5 had no effect, and this taken with its power of raising the blood pressure supports what I believe is the clinical experience of most medical men, namely, the uselessness of ergot in any form of hæmorrhage other than uterine. Two drachms of the liquid extract of hammamelis produced slight acceleration in one experiment. Lastly 20 grs. of potassium iodide produced no effect, a point of interest in connection with its use in the treatment of aneurisms, in which there is no suspicion of syphilis.

I now come to the consideration of substances which reduce coagulability. Extravascularly the additions of leech extract, citrates, tartrates, oxalates, malates to blood will prevent its clotting, but when taken by the mouth they do not affect it. Dr. Wright has however proved that citric or tartaric acid taken by the mouth will always lessen coagulability. Again by reducing the proportion of CO_2 in the blood either by rapid respiratory movements, or better by the administration of O_2 gas has the same effect. I believe that much of the benefit derived from the inhalation of oxygen in some cases of pneumonia depends more on its effect in clotting in a feeble contracting right ventricle than on anything else. Again, alcohol either half a pint of champagne or 10ccs of absolute alcohol (according to the taste of the experimenter) causes a considerable retardation, as from 6 to $9\frac{1}{2}$ minutes in one experiment. This fact should be borne in mind in giving alcohol during or after hæmorrhage, especially as this drug also stimulates the heart and causes vasodilatation.

Having thus briefly considered some results of recent research on coagulation, I pass on to their clinical application. *Firstly*, can we derive any help from them in controlling hæmorrhage? As regards external hæmorrhage $\frac{1}{4}$ or $\frac{1}{2}$ per cent. solutions of $CaCl_2$, especially if combined with solutions of tissue fibrinogens obtained from watery solutions of thyroid testicle act locally as physiological styptics which have none of the disadvantages of the actual cautery. But it is in internal hæmorrhages and diseased conditions in which hæmorrhages occur that they have and will prove of the greatest value. I will take the case of hæmoptysis. In July 1893 at Netley Hospital severe hæmoptysis in a case of phthisis came under my care. Hæmorrhage began at 2 A.M., and in spite of ergot and sulphuric acid a pint of blood had been lost by 10 A.M. Turpentine 15 minims every four hours was now ordered and continued until 2 A.M. the next morning. During this time the bleeding was less, but another pint was measured in the 24 hours, and blood which clotted in the vessel continued to be brought up. At 5 P.M., that is 15 hours after the last dose of turpentine, 15 grains of $CaCl_2$ was given. The hæmorrhage ceased within 20 minutes of this dose. The coagulation time taken before this dose was $4\frac{1}{2}$ minutes and afterwards $4\frac{1}{4}$, shewing only slight acceleration—a fact that has been observed in other cases in which active hæmorrhage has ceased after the use of this drug as if it was partly expended in producing its result. In this case the partial action of the turpentine followed by the complete action of the more powerful $CaCl_2$ fully bears out clinically the results of the above described experiments. I have had two other cases in which severe hæmoptysis ceased in from 10 to 20 minutes after 15-grain doses of $Ca\ Cl_2$ in one of which also other hæmostatics had previously failed. I have had no opportunity of trying it in hæmatemesis, but here again it is likely to prove of great value as both its local and general action would be brought into play. $CaCl_2$ has also checked otherwise uncontrollable hæmorrhage from the bladder. In the hæmorrhage of typhoid fever I think turpentine should be first tried except in severe cases, as $CaCl_2$ might favour too much the occurrence of that common complication of the disease, namely, thrombosis.

I now come to the remarkable results that have been obtained in hæmophilia. This disease in its less severe form is I believe far from being rare. At least I have met with several cases of it. Dr. Wright has found that in hæmophilia coagulation time is very much prolonged, up to over an hour in some cases, and that by the administration of $CaCl_2$ in 15-grain doses three times a day the time is very much accelerated and in several cases serious bleeding has been controlled. It is in severe cases of this disease in which $CaCl_2$ may fail to completely check bleeding that the inhalation of CO_2 gas is of such signal service. The external applications mentioned before have also checked hæmophilic bleeding. Moreover, hæmorrhages into joints and muscles are checked or controlled by $CaCl_2$ internally, as in the following instance. A hospital friend, a graduate of the London University, aged 30, suffered from hæmorrhages into his muscles and joints, one of which resulted in a stiff knee joint which compelled him to retire from the navy. On another occasion I aspirated some two ounces of blood from his elbow joint. In September 1893 I estimated his coagulability and found it to be between 10 and 11 minutes. This was quickened to 5 or 6 minutes by $CaCl_2$ gr. 15 t. d. s. He found that one of his brothers had an abnormally long coagulation time. I have since heard from him as follows: "Since you went away I have on five or six occasions when I felt an attack coming on of joint effusion, or when the joint had just filled, taken 60 to 80 gr. of $CaCl_2$ in three doses, and think I have succeeded in aborting an attack once or twice and in shortening it on other occasions." This is a good instance of a moderate degree of hæmophilia. The lack of $CaCl_2$ in the blood is evidently a very important, if not the most important, pathological feature of this disease.

As scurvy, a very common disease in India, is largely characterised by hæmorrhages, it occurred to me that this particular symptom might be due to a deficiency of calcium salts rather than to the diminution of the normal alkalinity of the blood. I have only been able as yet to examine the blood in one case, and found the coagulation time to be between 2 and 2¼ min. Lime juice has been observed to increase bleeding from the gums in scurvy owing doubtless to the coagulation-retarding properties of citric acid. In such a case a 5 per cent $CaCl_2$ gargle may be used locally or citrates and tartrates prescribed instead of lime juice.

In cases of thoracic abdominal and subclavian aneurism, which are not amenable to soft surgical treatment, it is of primary importance to increase the coagulability of the blood. I have mentioned that a low diet or prolonged fasts have the very opposite effect, whilst, on the other hand, Wooldridge found that a fatty diet largely increased the amount of intravascular clotting that could be produced in a dog by the injection of a given quantity of tissue fibrinogen. Moreover, I have shown that potassium iodide, even in a full dose, does not affect coagulation. The present method of treating these forms of aneurism by low diet and potassium iodide, except in so far as it reduces the force of the circulation, not infrequently to a dangerous extent, has therefore no rational basis.

On the other hand, by the methods I have described, a marked increase of the coagulability can be induced and maintained fairly constantly. These methods can moreover be applied in addition to MacEwan's or other surgical treatment. The administration of CO_2 gas would doubtless increase both the rapidity and, more important still, the firmness of clotting in any form of aneurism to which proximal or even digital compression could be applied, and would I think in many cases do away with the necessity of operative measures. It should however be remembered that regular determination of the coagulability must be made when such treatment is used for thoracic aneurisms, as in experiments on animals intravascular clotting has been produced by the administration of CO_2 after the use of $CaCl_2$. Dr. Wright therefore advises that CO_2 be not given if the coagulation time be below 2½ minutes.

Again, the administration of $CaCl_2$ by the mouth has proved of signal service in lessening or doing away with the danger of the hæmorrhage of an operation, for instance, in allowing of the removal of nasal polypi in a hæmophilic subject when a previous attempt had to be abandoned on account of bleeding. Moreover, in a case of long-standing jaundice, in which Mayo Robson feared to operate on account of the certainty of severe bleeding, he was enabled to do so without any trouble after giving $CaCl_2$ for two or three days beforehand. I would venture to suggest that it would be of great interest to determine the coagulation time in cases of leucocythemia, and if it is long to try if it could be accelerated sufficiently to enable the spleen to be successfully removed by operation, because all such attempts have, up to the present time, proved fatal from hæmorrhage, and consequently we are still in the dark as to whether the removal of the spleen would be of benefit in this disease as many have thought. It is known that a man is apparently none the worse for the removal of a wounded or ruptured spleen, and if the well known hæmorrhagic tendency of prolonged jaundice can be overcome, as I have just mentioned, why not that of leucocythemia?

The methods of retarding coagulability have not as yet proved of such service as the acceleration. The avoidance of alcohol and the vegetable acids in hæmorrhage has been already mentioned. Again, the addition of 1 in 200 sodium citrate to the blood will precipitate all the $CaCl_2$ and allow of it being kept liquid for an indefinite time. This I think is a more satisfactory method of keeping blood liquid for transfusion purposes than removing the fibrin by whipping and filtering through muslin, although I have used the latter method successfully.

Once more in those peculiar cases of paralysis, supervening shortly after the return to the surface, in men who have been working under an excessive air pressure as in divers, and which is attributed to a liberation of gases in the spinal cord followed by hæmorrhage, have recently at the Blackwall Tunnel Works been treated with renewed air pressure gradually reduced again to normal in a large iron vessel with success. In these cases a disproportionate amount of CO_2 gas is retained in the blood, and cyanosis is a marked feature of the disease. I believe the true pathology of this disease is an intravascular clotting followed by hæmorrhagic infarcts produced by the excess of CO_2 in the blood, similar to the hæmorrhagic infarcts of the liver produced by Wooldridge by the injection of tissue fibrinogen mentioned earlier in this paper. This is also strongly supported by the fact that Dr. Wright has produced intravascular clotting in animals by CO_2 gas. On account of this I would suggest that inhalation of O_2 would be a more rational and more easily applied remedy in the above cases than the apparatus in use at Blackwall.

Lastly, I would suggest the use of the vegetable acids or oxygen in cases where thrombosis is threatening or has commenced, such as after typhoid fever, in thrombosis of the cerebral sinuses which Gowers believes to be a frequent cause of infantile hemiplegia after diarrhœa, in the cerebral arteries, both syphilitic and that form which is so fatal after ligature of the common carotid artery, in the various thromboses which occur in the puerperal state, including that terrible form of obstruction of the pulmonary artery which Playfair holds to be in many cases a primary thrombosis,—in all these and other conditions which will occur to you in which there is an excessive tendency to thrombosis, these rational and scientifically based methods are worthy of a carefully observed trial. In a critical case I would not hesitate to inject boiled leech extract, which I have mentioned will keep blood fluid outside the body and which causes no ill effects when injected into the blood of animals.

I have now travelled quickly over a very wide field, which should furnish ample scope for thought and discussion. In conclusion, I can only hope that some of the suggestions I have so briefly and imperfectly brought forward may prove of real service in our everyday conflict with disease and death.

NOTES ON WEIGHTS OF HUMAN VISCERA AND CAPACITY OF THE INTESTINES IN PUNJABIS.

BY BELI RAM, RAI BAHADUR,
Lahore.

I WISH to lay before you some of the facts of my observations in the dissecting room of the Lahore Medical College. These concern (1) the weights of the viscera and calibre of the intestines as taken by a graduated cone; and (2) the position of the kidneys above the iliac crests. The total number of subjects from which I have drawn the following conclusions is 874.

I have attached tabular statements of my observations.

Statement "A" shews the weights of the principal viscera :—

BRAIN—

Subjects ...	Males ...	589
	Females ...	66

The average weight of the brain is found to be in :—

Male ...	44·2 ounces.
Female ...	40·6 ,,

The maximum weight of brain observed was 59 ounces in a Mahomedan male, *æt.* 30 years. His body weight was 113lbs., heart 10 ounces, right lung 37 ounces, pneumonic, left lung 12 ounces, liver 58½ ounces, spleen 20½ ounces.

The maximum weight observed was 48 ounces in a Mahomedan female, *æt.* 40. Her body weight was 72lbs. and the weights of her remaining viscera were : Brain 48 ounces, heart 6 ounces, right lung 28 ounces, left lung 23 ounces, liver 50 ounces, spleen 9½ ounces, right kidney 5 ounces, left kidney 5½ ounces.

The average difference noted between the brains of male and female subjects is 3·6 ounces.

I think it will not be out of place to state here that all the subjects of my brain observations were of 21 years and upwards.

HEART—

Subjects ...	Males ...	706
	Females ...	83

I find that the average weight of the heart was in—

Male ...	7·2 ounces.
Female ...	6·2 ,,

The difference in the average weight of the heart of the two sexes being 1 ounce only.

The maximum weight of the heart was found to be 20 ounces in a Mahomedan male, *æt.* 30 years, who died in October 1892 from cellulitis of the forearm. The weights of the remaining viscera of this subject were found to be—

Brain ...		... 49 ounces.
Lung	right	... 19 ,,
	left	... 15 ,,
Liver ...		... 50 ,,
Spleen ...		... 12½ ,,
Kidneys	right	... 4½ ,,
	left	... 4¾ ,,

LUNGS—

The average weight of lungs as noted from—

Subjects ...	Males ...	right ...	716
		left ...	698
	Females.	right ...	82
		left ...	81
Weights noted	Males ...	right lung ...	20·6 ounces.
		left ,, ...	14·8 ,,
	Females.	right lung ...	15·9 ,,
		left ,, ...	13·2 ,,

The difference between the right and the left lungs of a male subject was noted 5·8 ounces, and that between lungs of two sides of a female subject 2·7 ounces. The average difference in the weights of the lungs of the two sexes is :—

Right lung ...	... 4·7 ounces.
Left ,, ...	... 1·6 ,,

I must state that the maximum weight observed was that of a pneumonic lung. Hence it has not been noted in the annexed statement.

LIVER—

Subjects ...	Male ...	714
	Female ...	77

I find that the average weight of liver in—

Males =	46·5 ounces.
Females =	40·2 ,,

The average difference between the weights of the livers of two sexes being 6·3 ounces.

The average weight of the liver you will notice is a little below the average weight of liver noted in English text books of medicine, *i.e.*, 50 to 60 ounces or 3 to 4lbs.

The maximum weight of the liver noted was in—

Males ...	... 128 ounces.
Females ...	... 104 ,,

The heaviest liver, 128 ounces, was found in a strong prisoner of Lahore District Jail, *æt.* about 42 years. His body weight was 143lbs. The weights of his remaining viscera were as follows :—

Brain		47 ounces.	
Heart		14 ,,	
Lungs	right	41 ,,	pneumonic.
	left	28 ,,	
Spleen		80 ,,	
Kidneys	right	7 ,,	
	left	7½ ,,	

The maximum weight of liver was noted in a Mahomedan female, *æt.* about 27 years.

The weights of her viscera were as follows :—

Brain	45 ounces.
Heart	7 ,,
Right lung	12 ,,
Left ,,	12 ,,
Liver	104 ,,
Spleen	13 ,,
Kidneys	4 ,, each.

SPLEEN—

Subjects	Males	716
	Females	76

I found that the average weight of the spleen among Punjabis is in—

Males	17·6 ounces.
Females	13·2 ,,

which is more than double the average weight noted in English books.

The weight of the healthy spleen being 5 to 7 ounces, it is quite clear that the spleen of most of the persons in this province is enlarged probably from malarial cachexia.

The huge big spleen, the weight of which is noted to be 116 ounces, was found in a prisoner in Lahore Central Jail. The weight of his body was 94lbs. and the weight of his remaining viscera are noted below :—

Brain	50 ounces.
Heart	6 ,,
Right lung	16 ,,
Left ,,	14 ,,
Liver	64 ,,
Right kidney	3¾ ,,
Left ,,	4 ,,

KIDNEYS—

As noted from—

Subjects	Males	right kidney	697
		left ,,	640
	Females	right ,,	75
		left ,,	76

It is found that the average weight of kidneys is in—

Males	right kidney	4·2ounces.
	left ,,	4·3 ,,
Females	right ,,	3·7 ,,
	left ,,	3·7 ,,

The difference between the average weights of the kidneys n two sexes being—

Right kidney	·5 ounces.
Left ,,	·6 ,,

The largest kidney was found in a Mahomedan male, *æt.* about 44. The weight of his body was 82lbs The weights of his remaining viscera were—

Heart		9 ounces.
Right lung		25 ,,
Left ,,		29 ,,
Liver		63 ,,
Spleen		22 ,,
Kidneys	right	11½ ,,
	left	13 ,,

On referring to Statement "B." it will be found that the average height of the lower border of the kidneys from the iliac crest is—

Right kidney	1·5 inches.
Left ,,	2·04 ,,

Statement No. "C." shows that the average capacity of the small and large intestines is as follows :—

Pyloric opening	·97 inches.
Duodenum	1·58 ,,
Jejunum	1 41 ,,
Ileum	1·26 ,,
Ilio colic opening	1·02 ,,
Cœcum	3 06 ,,
Ascending colon	2 55 ,,
Transverse colon	2·40 ,,
Descending colon	2·25 ,,
Sigmoid Flexure	2·15 ,,
Rectum	1·97 ,,

STATEMENT NO. "A."

Shews the weights of the principal Viscera as observed in the Dissecting Room of the Lahore Medical College.

NAME OF THE VISCUS.	NO. OF OBSERVATIONS.		MAXIMUM WEIGHT OBSERVED.		AVERAGE WEIGHT.	
	Males.	Females.	Males.	Females.	Males.	Females.
			Ounces.	Ounces.	Ounces.	Ounces.
Brain	589	66	59	48	44·2	40·6
Heart	705	83	20	12·5	7·2	6·3
Lungs Right	716	82	...	...	20·6	15·9
Left	698	81	...	...	14·8	13·2
Liver	714	77	128	104	46·5	40·2
Spleen	716	76	116	52	17·6	13·2
Kidneys Right	697	75	11·5	9	4·2	3·7
Left	640	76	13	10	4·3	3·7

STATEMENT NO. "B."

Shews the position of Kidneys above the Iliac Crest as observed in the Dissecting Room of Lahore Medical College.

POSITION OF KIDNEYS ABOVE ILIAC CREST.

No. of inches above iliac crest.	NO. OF OBSERVATIONS.	
	Right.	Left.
·5	1	1
1·0	3	3
1·25	2	...
1·5	36	7
1·75	...	1
2·0	5	30
2 25	1	1
2·5	4	5
3·0	2	3
3·25	...	1
3·5	...	1
4·0	...	1
Total No. of Observations	54	54
	Inches.	
Average height above iliac crest...	1·5	2·04

STATEMENT No. "C."

Shews the calibre of the intestines as observed in the Dissecting Room of Lahore Medical College.

No. of Inches	No. of Observations.											
	Rectum.	Sigmoid Flexure.	D Colon.	T. Colon.	A. Colon.	Cæcum.	Ilium	Jejunum	Duodenum.	Ilio colic opening.	Pyloric opening.	
·25	..	..	..	..	..	..	..	..	..	3	3	·25
·5	1	..	..	..	..	..	2	..	..	51	65	·5
·75	..	..	1	1	..	..	12	1	2	63	81	·75
1·0	9	1	1	3	1	..	118	56	3	177	126	1·0
1·25	9	6	4	2	1	..	194	114	17	171	59	1·25
1·5	72	43	20	18	10	2	94	181	118	26	44	1·5
1 75	33	57	34	23	7	1	24	92	105	2	4	1·75
2·0	135	114	108	59	42	7	10	24	116	1	5	2·0
2·25	53	60	76	82	64	14	1	12	35	..	..	2·25
2·5	51	74	73	107	82	54	..	2	27	..	1	2·5
2 75	10	28	48	65	82	45	..	..	3	..	..	2·75
3·0	8	18	18	38	76	120	..	..	1	..	..	3·0
3·25	..	1	2	19	30	45	..	..	..	..	..	3·25
3·5	..	..	1	5	23	72	..	..	..	..	..	3·5
3·75	..	..	1	1	3	25	..	..	..	..	..	3 75
4 0	..	..	..	..	..	22	..	..	..	..	..	4·0
Total No. of Observations ..	378	402	387	423	421	407	455	482	427	494	388	
Average in inches ..	1·97	2·15	2 25	2·40	2·55	3·06	1·26	1 41	1·58	1·02	·97	

ABNORMALITIES IN THE HUMAN BODY.

BY BALKISHEN KAUL,

Asst. Surgeon, Lahore.

THE subject I have chosen for this paper is "Abnormalities in the Human Body." This subject does not admit of any discussion, and I shall confine myself to a bare statement of facts.

A large number of abnormalities is noted (Bk.) in the anatomical records of the Lahore Medical College every year, but as the paper is to be a short one, I select only two most interesting and rare cases of them:—

Case No. I is an instance of transposition of thoracic and abdominal viscera. Although cases similar to this have been alluded to in standard books, yet this one is peculiarly interesting, owing to the fact of its being the first of its kind observed in our institution.

Case No. II, in which the right pulmonary veins open in the right auricle, is of great interest, because, so far as my limited knowledge extends, it has not been noticed up to the present.

CASE NO. I.

Transposition of Thoracic and Abdominal Viscera.

Rahima, a male patient admitted in the Mayo Hospital, Lahore, on the 15th of November 1888, died on the 30th of December 1888.

The patient's age on admission into the hospital was 22 years.

When brought to the dissecting room, the body seemed to be well nourished. The weight of the body was 64lbs., and the height 5 feet 6 inches.

On opening the thoracic and abdominal cavities, the following observations were made :—

THORAX—*Heart.*—The heart was twisted upon itself, the anterior surface formed by the left ventricle, and the posterior surface by the right ventricle. The right auricle was situated posteriorly, and to the left side lying in front of the root of the left lung. The left auricle was in front, and on the right side.

The apex of the heart was towards the left and opposite the sixth intercostal space.

The pulmonary artery (at its origin) was behind the ascending aorta, running upwards towards its right side. The left branch of the pulmonary artery crossed behind the ascending aorta and superior vena cava, whilst the right branch crossed the vertebral column opposite the fifth dorsal vertebra.

The right internal jugular and right subclavian veins united in the thoracic cavity at about 2 inches above the arch of aorta, crossed in front of the right common carotid and the innominate arteries, and joined the left innominate vein opposite the first rib. The left innominate vein was about half the length of the right.

The superior vena cava ran along the left side of the ascending aorta and terminated in the right auricle opposite the third rib.

The aorta rose opposite the seventh, and its arch was opposite the sixth, dorsal vertebra. The transverse portion gave the three branches as usual : one of these, the innominate, went to the left side of the neck, head and left upper extremity, while the common carotid and subclavian supplied the right side of neck, head and right upper extremity.

The right pulmonary vein crossed opposite the sixth dorsal vertebra, and emptied itself into the left auricle.

The left pulmonary vein passed behind the right auricle and in front of the thoracic aorta, and emptied itself into the left auricle opposite the seventh dorsal vertebra.

Both lungs had two lobes each. The left upper lobe was diseased (third stage of phthisis), and was adherent to the parietes with a thick deposit of lymph. The œsophagus crossed in front of the transverse part of the arch of the aorta, passed downwards, crossed the thoracic aorta and ended on its right side opposite the tenth dorsal vertebra.

The left recurrent laryngeal nerve passed behind the innominate artery.

The phrenic nerve passed behind the left innominate vein and along the left border of the superior vena cava.

Liver was found in the left hypochondriac region under the left costal arch. The left lobe was in the epigastric region and extended to the right hypochondriac region, while the right lobe was in the left hypochondriac region. The liver weighed 40¼ ounces.

The *spleen* and its capsule were enlarged. The spleen was situated under the right costal arch and extended to the epigastric and right lumbar regions. The spleen weighed 33½ ounces.

Stomach.—Its fundus was on the right side and the pyloric end to the left below the liver.

Intestines.—Duodenum was on the left side, the sigmoid flexure in the right and the cæcum in the left iliac fossa. The rectum began opposite the right sacko-iliac synchondrosis.

Pancreas was opposite the second and third dorsal (Bk.) vertebra, the tail was on the right, the head to the left side.

Kidneys.—The right kidney was opposite the 3rd, 4th and 5th lumbar vertebra, and was about half the size of the left. It had no regular hilum, the ureter and vessels entered a depression below the middle of the anterior surface. One small abnormal renal artery entered the outer border of the right kidney. There were two renal veins; one joined the left common iliac vein, crossed in front of the left common iliac artery; the other issued from the apex of the kidney, crossed the abdominal aorta opposite the 2nd lumbar vertebra, and ended in the inferior vena cava.

The left kidney was double the size of the right and was situated on a higher level opposite the 1st, 2nd, 3rd, 4th lumbar vertebræ.

Abdominal aorta passed in front of the vertebral column and divided into its terminal branches opposite the body of the 4th lumbar, a little to the left of the median line.

Inferior vena cava passed along the left border of the abdominal aorta. The right iliac vein was to the inner side of the right iliac artery, passed behind the left common iliac artery, and joined the left common iliac vein opposite the left side of the body of the 4th lumbar vertebra.

The left common iliac vein passed along the outer surface of the left common iliac artery.

Diaphragm.—The canal opening was on the left, the œsophageal on the right side whilst the aortic opening was behind and between the two.

Weights of the viscera.

Heart	6½	ounces.
Right Lung	14	"
Left	23	"
Liver	40½	"
Spleen	33½	"
Right Kidney	2½	"
Left "	6	"

Case No. 2.

A Patent Foramen Ovalis of Heart.

The body of a Hindu male, named D.—D—, about 40 years old, who died of double pneumonia.

The right pulmonary veins opened into the right auricle just below the opening of the superior vena cana and above the annulus ovalis. There was free communication between the two auricles, as the foramen ovale was patent.

DIABETES MELLITUS.

BY KOILASH CHUNDER BOSE, RAI BAHADUR, L.M.S.

The author pointed out that, in ancient Hindoo medical literature, *bohumootra* (polyuria) was the term applied to augmented secretion of urine, with thirst, dry skin, gradual emaciation and loss of strength. No special attention was paid by Indian physicians to diabetes till the advent of the Western system of medicine. It was surmised that one-tenth of the mortality of Calcutta was directly or indirectly attributable to diabetes. The temporary glycosuria of errors of diet and of pregnancy was to be distinguished from the true disease. Two varieties of diabetes were met with,—the acute and the chronic,—of which the latter was by far the more common. An associated form of slight glycosuria with phosphaturia was also met with. The sequence of symptoms seemed to be loss of virile power, digestive disorders, followed by polyuria and debility. Subnormal temperatures were common, probably due to languid circulation. The impaired nutrition of patients predisposes to pneumonia, phthisis of the chronic pneumonic form, low forms of phlegmonous cellulitis after slight injuries, furunculi. Formication, tingling of the extremities, tremors, vertigo, cephalalgia, palpitation are the usual nervous symptoms. In Indian diabetes the knee-jerk is lost very early. The presence of albumen in diabetic urine was not considered as of serious import by the author, provided venal casts were not present in any quantity.

Cases of temporary traumatic diabetes following injuries to the head were related. The evil effects of over-crowding, and bad hygienic conditions generally, as predisposing factors, were remarked on. In proof that a diet, almost entirely composed of starchy food, did not *per se* produce diabetes, the fact was instanced that Hindoo widows, living on a wholly farinaceous diet, did not suffer. The *Jains*, likewise, whose only animal food is milk and butter, do not suffer. The *Sadhus*, *Jogees*, and *Choibays* of Muttra live upon sweets and yet escape.

Early marriage could not be considered a cogent cause of diabetes. In the accompanying table of 250 cases from the file of the Assistant Chemical Examiner to the Government of Bengal there was not one case of a female.

Early marriage has been in vogue from remote times, and yet, as far as females are concerned, the deleterious effect has been practically nil (*vide* Sex distribution at the foot of Table 1). *(See page 128a.)*

The influence of heredity could not be scientifically established. Mental disturbances often bear a distinct causal relation to diabetes. In the experience of the author, it does not stand in any causal relation to diabetes in India. As far as age incidence is concerned, young adults and the middle aged are affected.

In the Table (1) it is shown that Hindoos suffered much more than Mahomedans. The great prevalence among educated Bengalis was attributed to the effect of competition in the struggle of life among a people weak in muscular power and nerve stamina, but with many intellectual aspirations. Success in life was followed by the enervating effects of luxury.

The exciting causes of dyspepsia were held to be indirectly, but none the less strongly, those of diabetes. The worry of official life, with its lack of time for proper digestion and assimilation of food, slowly but surely led to the establishment of diabetes.

Cases of diabetic coma were noted, in which the temperature rose to 107° before the fatal issue. A condition of incoherence preceding by an interval the occurrence of coma was regarded as a certain sign of fatal termination. The author did not regard the high specific gravity of urine as a certain indication of diabetes. The highest specific gravity does not mean the largest amount of sugar. This is shown by reference to Tables (1 & 2), and from Table (3) it will be seen that the correlation of specific gravity to the amount of sugar is at best a very approximate one. Indian diabetes may be contrasted with Western diabetes as shown in the accompanying table (Table 4):—

TABLE I.

Sp.gr. of Cases	1003	1004	1005	1006	1007	1008	1010	1012	1013	1014	1015	1016	1017	1018	1020	1021	1022	1023	1024	1025	1026	1027	1028	1030	1031	1032	1033	1034	1035	1036	1037	1038	1040	1042	1046	Total.
Total Cases...	1	1	2	4	1	1	10	5	3	3	6	6	2	7	24	2	17	7	10	12	19	3	17	21	5	14	6	10	12	8	1	4	3	1	2	250
Cases with Sugar only	0	0	0	0	0	1	2	3	2	2	2	4	0	6	12	0	11	6	6	9	13	3	15	17	5	13	6	9	10	7	0	3	3	1	2	173
Cases with Albumen only ...	1	1	2	2	1	0	5	2	1	1	1	2	1	0	8	1	5	0	3	2	6	0	2	2	0	1	0	1	2	1	1	1	0	0	0	56
Cases with trace only of Sugar ...	0	0	0	1	0	0	2	0	0	0	2	0	1	1	4	1	1	1	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	18
Cases containing Sugar below 1%	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

With Albumen	... 56	Cases.
„ Trace only of Sugar ...	... 18	„
„ Below 1 grain of Sugar, per oz....	3	„
„ Sugar only	... 173	„
Total	... 250	Cases.

Sex.

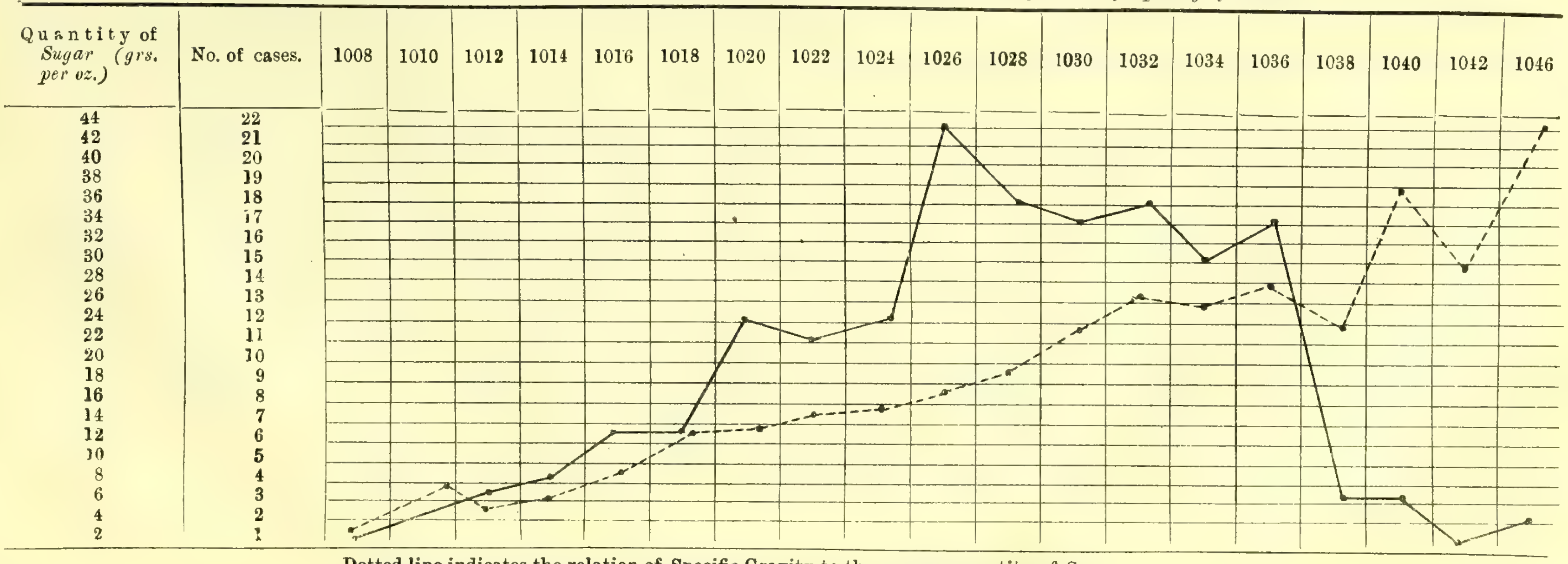
Males ...	250
Females ...	*Nil*
Total ...	250

Races.

Hindoos ...	231
Mahomedans ...	2
Europeans ...	17
Total ...	250

TABLE I (*a*).

Graphic representation of the relation of Specific Gravity to the quantity of Sugar and frequency of cases.



Dotted line indicates the relation of Specific Gravity to the average quantity of Sugar.
Black line indicates the relation of the frequency of cases with the Specific Gravity.

TABLE 2.

ANALYSIS OF THREE SAMPLES OF URINE.

BY R. C. DUTT, F.C.S.

	1st.	2nd.	cg. Albumen. 3rd.
Total solids	9·73	11·9	14·32
Albumen	1·00	4·0	5·76
Organic matters	4·12	5·12	11·68
Ash	4·6	2·84	2·264
Sp. gr. by urinometer	1007°	1006°	1006°
Sp. gr. by bottle @ 15°C ...	1007·1°	1005·8°	1006°

Table shewing the fall of Sp. Gr. with the addition of Albumen.

Sp. gr. of white of egg by urinometer	1035°
Ditto bottle	1039°
25 c. c. of white of egg mixed with 50 c.c. distilled water gives a sp gr. by urinometer	1010°
Ditto bottle ...	1011°
5% Albumen with distilled water sp. gr. by urinometer stands	1000°
3·3% Albumen and 5% cbloride of sodium (Nacl) gives a sp. gr. of	1030$_\circ$
5% Nacl solution sp. gr.	1032°
10% Albumen with distilled water	1002°

TABLE 3.

CASES OF DIABETES.

No.	Sex.		Race.			Sp. Gr. of Urine.	Sugar.	Albumen.	Percentages of Sugar.
	M.	F.	Hin.	Mah.	Eur.				
1	1	...	1	...	...	1010	Trace.	2·05	
2	1	...	1	...	...	1020	"	*Nil.*	
3	1	...	1	...	...	1006	"	1·94	
4	1	...	1	...	...	1030	13·12	*Nil.*	
5	1	..	1	...	...	1034	27·14	"	
6	1	...	1	...	...	1024	16·6	0·5	
7	1	...	1	...	...	1006	Trace.	*Nil.*	
8	1	...	1	...	...	1028	27·34	"	
9	1	...	1	...	..	1007	Trace.	1·55	
10	1	..	1	...	...	1010	"	2·3	
11	1	..	1	...	...	1015	"	*Nil.*	
12	1	..	1	...	...	1033	25·3	"	
13	1	...	1	...	...	1038	28·8	"	
14	1	...	1	...	.	1033	19·9	"	
15	1	...	1	...	...	1027	2·15	"	
16	1	..	1	...	...	1032	21·8	"	
17	1	...	1	...	...	1021	15·3	Trace.	
18	1	...	1	...	...	1032	31·06	*Nil.*	
19	1	...	1	...	...	1016	7·2	"	
20	1	...	1	...	...	1035	Trace.	P'snt.	
21	1	...	1	...	...	1026	16·6	"	
22	1	...	1	...	...	1016	8·	*Nil.*	
23	1	...	1	...	...	1034	21·8	"	
24	1	...	1	...	...	1023	Trace.	"	
25	1	...	1	...	...	1040	31·23	"	
26	1	...	1	...	...	1036	31·2	"	
27	1	.	...	1	...	1035	24·06	"	
28	1	...	1	...	...	1030	17·	"	
29	1	..	1	...	...	1020	20·	3·1	
30	1	...	1	...	...	1023	17·9	*Nil.*	
31	1	...	1	...	...	1010	Trace.	"	
32	1	...	1	...	...	1033	31·2	"	
33	1	...	1	...	...	1017	7·26	P'snt.	
34	1	...	1	...	...	1030	21·57	*Nil.*	
35	1	..	1	...	...	1020	Trace.	"	
36	1	...	1	...	...	1025	"	"	
37	1	...	1	...	...	1034	24·06	"	
38	1	...	1	...	...	1026	8·75	"	
39	1	...	1	...	...	1023	5·	"	
40	1	...	1	...	...	1015	2·18	"	
41	1	...	1	...	...	1025	21·8	"	

TABLE 3—contd.

No.	Sex.		Race.			Sp. Gr. of Urine.	Sugar.	Albumen.	Percentages of Sugar.
	M.	F.	Hin.	Mah.	Eur.				
42	1	...	1	...	...	1024	18·2	*Nil.*	
43	1	...	1	...	...	1015	Trace.	"	
44	1	...	1	...	...	1032	36·3	"	
45	1	...	1	...	...	1012	Trace.	1·7	
46	1	...	1	...	...	1026	27·12	*Nil.*	
47	1	...	1	...	...	1032	27·34	"	
48	1	...	1	...	...	1036	27·34	"	
49	1	...	1	...	...	1031	31·06	"	
50	1	...	1	...	...	1022	13·12	"	
51	1	..	1	...	...	1026	16·18	Trace.	
52	1	...	1	...	...	1026	14·43	*Nil.*	
53	1	..	1	...	...	1026	13·66	Trace.	
54	1	...	1	...	...	1023	16·62	*Nil.*	
55	1	...	1	...	...	1020	16·52	"	
56	1	...	1	...	...	1022	13·56	"	
57	1	...	1	...	...	1020	19·68	"	
58	1	...	1	...	...	1037	36·3	Trace.	
59	1	...	1	...	...	1028	7	Excess.	Chylous Urine.
60	1	..	1	...	...	1028	21·8	*Nil.*	
61	1	...	1	...	...	1028	10·9	"	
62	1	...	1	...	...	1013	8·7	Con'ble	
63	1	...	1	...	...	1005	14·5	P'snt.	
64	1	...	1	..	...	1020	Trace.	Trace.	
65	1	...	1	...	...	1022	"	"	
66	1	...	1	...	...	1035	16·5	"	
67	1	...	1	...	...	1025	24·6	*Nil.*	
68	1	...	1	...	...	1018	12·4	"	
69	1	..	1	...	...	1012	Trace.	P'snt.	
70	1	...	1	...	...	1024	4·	Trace.	
71	1	...	1	...	...	1016	8·	P'snt.	
72	1	...	1	...	...	1010	Trace.	Con'ble.	
73	1	..	1	...	...	1020	27·12	Trace.	
74	1	...	1	...	...	1024	24·5	*Nil.*	
75	1	...	1	...	...	1004	Trace.	P'snt.	
76	1	...	1	...	...	1027	20·5	*Nil.*	
77	1	...	1	...	...	1010	Trace.	P'snt.	
78	1	...	1	...	...	1006	"	Trace.	
79	1	...	1	...	...	1013	2·4	*Nil.*	
80	1	...	1	...	...	1036	27·12		
81	1	...	1	...	...	1003	Trace.	Trace.	
82	1	...	...	...	1	1026	19·68	"	
83	1	...	1	...	...	1028	22·6	*Nil.*	
84	1	...	1	...	...	1040	36·31	"	
85	1	...	...	1	...	1032	31·06	"	
86	1	...	1	...	..	1005	Trace.	Trace.	
87	1	...	1	...	...	1015	10·93	0·13 gr. per oz.	
88	1	...	1	...	...	1032	21·87	Trace.	
89	1	...	...	...	1	1020	15·4	*Nil.*	
90	1	...	1	...	...	1017	Trace.	"	
91	1	...	...	...	1	1024	24·25	Trace.	
92	1	...	1	..	...	1028	21·8	"	
93	1	...	..	...	1	1034	16·5	"	
94	1	...	1	...	...	1038	30·3	"	
95	1	...	1	...	...	1030	25	"	
96	1	...	1	...	...	1022	Trace.	*Nil.*	
97	1	...	1	...	...	1035	2[illegible]·8	"	
98	1	...	1	...	...	1000	Trace.	P'snt.	
99	1	...	1	...	...	1035	28·8	*Nil.*	
100	1	...	1	...	...	1020	Trace.	"	
101	1	...	...	...	1	1018	P'snt.	"	
102	1	...	1	..	...	1022	P'snt.	Trace.	
103	1	...	...	...	1	1016	2·25	P'snt.	
104	1		1	...	...	1024	P'snt.	*Nil.*	
105	1	...	1	...	...	1020	3·3	Trace.	
106	1	...	...	...	1	1030	21·87	"	
107	1	...	1	...	...	1026	18·9	"	
108	1	...	1	...	...	1025	19·68		
109	1		1	...	...	1020	13·12	"	

TABLE 3—contd.

No.	Sex.		Race.			Sp. Gr. of Urine.	Sugar.	Albumen.	Percentages of Sugar.
	M.	F.	Hin.	Mah.	Eur.				
110	1	..	1	...	...	1022	17·5	Trace.	...
111	1	...	1	...	..	1016	21·8	*Nil.*	
112	1	...	1	...	...	1022	15 31	"	
113	1	...	1	...	...	1026	17·5	"	
114	1	...	1	..	...	1020	Trace.	"	
115	1	...	1	...	...	1021	"	"	
116	1	...	1	...	...	1028	3·	"	
117	1	...	1	...	...	1026	21·87	"	
118	1	...	1	...	...	1025	13·5	P'snt.	
119	1	...	1	...	...	1012	5·46	*Nil.*	
120	1	...	1	...	...	1027	21·87	"	
121	1		1	...	...	1010	6 12	"	
122	1	...	1	...	...	1020	13 56	"	
123	1	..	...	...	1	1014	5 2	"	
124	1	...	...	...	...	1020	15·31	"	
125	1	...	1	...	...	1018	14·21	"	
126	1	...	1	..	...	1016	12·46	"	
127	1	.	1	...	...	1028	21.87	"	
128	1	.	...	...	1	1031	21·87	"	
129	1	...	1	...	...	1030	15·5	"	
130	1	...	1	...	...	1022	P'snt.	Trace.	
131	1	...	1	...	...	1030	Trace.	*Nil.*	
132	1	...	...	...	1	1012	4·	"	
133	1	...	...	...	1	1010	Trace.	"	
134	1	...	1	...	...	1026	10·09	"	
135	1	...	1	...	...	1038	7·1	"	
136	1	...	...	...	1	1008	2·8	"	
137	1	...	...	...	1	1022	3·	"	
138	1	...	...	...	1	1036	27·12	Trace.	
139	1	...	1	...	...	1026	19·68	"	
140	1	...	...	.	1	1026	17·5	*Nil.*	
141	1	...	1	...	...	1010	10·95	⅓ bulk.	2·5 %
142	1	..	1	...	...	1026	21·875	*Nil.*	5· "
143	1	...	1	...	...	1036	24·0625	"	5·5 "
144	1	..	1	...	...	1014	10·0625	¼ bulk.	
145	1	..	1	...	...	1014	5·4	*Nil.*	
146	1	...	1	...	...	1026	5·6	"	
147	1	...	1	...	...	1018	12·8	"	
148	1	.	1	...	...	1031	29 3125	"	6·7 %
149	1	...	1	...	...	1028	18 375	"	4·2 "
150	1	...	1	...	...	1023	10 9375	"	2·5 "
151	1		1	...	...	1034	17·5	"	4· "
152	1	...	1	...	...	1034	24·0625	"	5·5 "
153	1	...	1	...	...	1032	13·5025	"	3·1 "
154	1	...	1	...	...	1032	24·0625	"	5·5 "
155	1	...	1	...	...	1030	18·375	"	4·2 "
156	1	...	1	...	...	1020	29·75	¼th	6·8 "
157	1	...	1	...	...	1039	15·75	*Nil.*	3·6 "
158	1	...	1	...	...	1035	15·75	"	3·6 "
159	1	...	1	...	...	1030	25·375	"	5·8 "
160	1	...	1	...	...	1020	10·5	"	2·4 "
161	1	...	1	...	...	1026	25·375	"	5·8 "
162	1	...	1	...	...	1034	31·5	"	7·2 "
163	1	...	1	...	...	1024	12·25	"	2·8 "
164	1	...	1		...	1028	20·125	"	4·6 "
165	1	...	1	...	...	1028	24·0625	"	5·5 "
166	1	...	1	...	...	1030	28 4375	"	6·5 "
167	1	...	1	...	..	1028	20·125	"	4·6 "
168	1	..	1	...	1	1015	0 875	"	0·2 "
169	1	...	1	...	...	1030	28·875	"	6·6 "
170	1	...	1	...	...	1024	20·125	"	4·6 "
171	1	..	1	...	...	1024	20 125	"	4·6 "
172	1	...	1	...	1	1015	1 75	"	0·4 "
173	1	...	1	...	...	1026	29·75	"	6·8 "
174	1	..	1	...	...	1035	28·4375	"	6·5 "
175	1	.	1	...	...	1028	6·5625	"	1·5 "
176	1	...	1	...	...	1025	19·03125	"	4·35 "
177	1	...	1	...	...	1020	14·4375	"	3·3 "
178	1	...	1	...	...	1022	11 375	"	2·6 "
179	1	...	1	...	...	1020	14·875	"	3·4 "

TABLE 3—concld.

No.	Sex.		Race.			Sp. Gr. of Urine.	Sugar.	Albumen.	Percentages of Sugar.
	M.	F.	Hin.	Mah.	Eur.				
180	1	...	1	...	...	1007	0·306	*Nil.*	0·07 %
181	1	..	1	...	...	1028	25·37	"	5·8 "
182	1	...	1	...	...	1030	28·4375	"	6·5 "
183	1	..	1	...	...	1030	28 875	"	6·6 "
184	1	...	1	...	...	1032	31 9375	"	7·3 "
185	1	...	1	...	...	1028	25·37	"	5·8 "
186	1	...	1	...	...	1031	29·312	"	6·7 "
187	1	..	1	...	...	1022	15·75	"	3·0 "
188	1	...	1	...	...	1018	12·25	"	2·8 "
189	1	...	1	...	...	1022	12 25	"	2·8 "
190	1	...	1	...	...	1025	18·375	"	4·2 "
191	1	...	1	...	...	1032	25·375	"	5·8 "
192	1	...	1	...	...	1036	28·4375	"	6·5 "
193	1	...	1	...	..	1010	0·843	"	0·193 "
194	1	..	1	...	...	1013	11·375	"	2·6 "
195	1	...	1	...	...	1020	7·875	"	1·8 "
196	1	..	1	...	...	1035	28·0	"	6·4 "
197	1	...	1	...	...	1025	15·75	"	3 6 "
198	1	...	1	...	...	1020	7·87	"	1·8 "
199	1	...	1	...	...	1038	35·875	"	8·2 "
200	1	...	1	...	...	1010	9·62	"	2·2 "
201	1	...	1	...	...	1034	32·81	"	7·5 "
202	1	...	1	...	...	1035	32·81	"	7·5 "
203	1		1	...	...	1028	23·62	"	5·4 "
204	1	..	1	...	...	1032	27·12	"	6·2 "
205	1	...	1	...	...	1040	35·	"	8· "
206	1		1	.	...	1028	15·31	"	3·5 "
207	1	...	1	...	...	1030	22·75	"	5·2 "
208	1	...	1	...	...	1026	11·3	"	2·6 "
209	1	...	1	...	..	1035	32·81	"	7 5 "
210	1	...	1	...	...	1030	28·87	"	6·6 "
211	1	...	1	...	...	1022	14·	"	3·2 "
212	1		1	...	...	1018	14·	"	3·2 "
213	1	..	1	...	...	1034	9·75	"	6·8 "
214	1	..	1	...	...	1018	11·37	"	2·6 "
215	1	...	1	...	...	1026	4·81	"	1·1 "
216	1	...	1	...	...	1033	27·12	"	6·2 "
217	1	...	1	...		1036	32·81	"	7·5 "
218	1	...	1	...	..	1025	15·31	"	3·5 "
219	1	...	1	...	...	1022	11·37	"	2·6 "
220	1	...	1	...	...	1035	24·5	"	5·6 "
221	1	...	1	...	...	1032	28·87	"	6·6 "
222	1	...	1	...	...	1036	32·81	"	7·5 "
223	1	...	1	...	...	1035	31·5	"	7 2 "
224	1	...	1	...	..	1028	15·31	"	3·5 "
225	1	...	1	...	.	1020	9·81	0·21%	2·1 "
226	1	...	1	...	...	1042	29·75	*Nil.*	6·8 "
227	1	..	1	...	...	1033	28·87	"	6·6 "
228	1	...	1	...	...	1025	15·31	"	3 5 "
229	1	...	1	...	...	1033	28·87	"	6·6 "
230	1	...	1	...	...	1030	28·87	"	6·6 "
231	1	...	1	...	...	1020	9·18	"	2·1 "
232	1	...	1	...	...	1022	15·31	0·42%	3·5 "
233	1		1	...	...	1030	24 5	*Nil.*	5·6 "
234	1	...	1	...	...	1032	27·12	"	6·2 "
235	1	...	1	...	...	1046	43·75	"	10· "
236	1	..	1	...	...	1023	15·31	"	3·5 "
237	1	...	1	...	...	1025	14·0	"	3·2 "
238	1	...	1	...	...	1031	29·75	"	6·8 "
239	1	...	1	...	...	1024	19·68	"	4·5 "
240	1	...	1	...	...	1025	19·68	"	4·5 "
241	1	...	1	...	..	1035	27·12	"	6·2 "
242	1	...	1	...	...	1022	15·31	"	3·5 "
243	1	...	1	...	...	1024	14 0	"	3·2 "
244	1	...	1	...	...	1046	43·75	"	10· "
245	1	...	1	...	...	1030	27·12	"	6·2 "
246	1	...	1	...	..	1032	27·75	"	6·8 "
247	1	...	1	...	...	1035	27·12	"	6·2 "
248	1	...	1	...	...	1012	4·81	"	1·1 "
249	1	...	1	...		1022	11·37	"	2·6 "
250	1	..	1	...	...	1020	15·31	"	3·5 "
Gd. tl.	250	...	231	2	17	...	...	...	...

TABLE 4.

	Western Diabetes.	Diabetes as seen in India.
1. Age	... Early	... Middle life; rarely, if ever, in early age.
2. Sex	... Females about $\frac{1}{8}$	... Less than $\frac{7}{10}$
3. Emaciation	... Well marked	... Rare.
4. Appetite	... Ravenous	... Dull and capricious, rarely ravenous.
5. Thirst	... Oppressive	... Not so much.
6. Skin	... Dry from the very commencement.	Only in the advanced stage of the disease.
7. Sugar	... Persistent	... Temporarily absent in urine.
8. Albumen	... Bespeaks danger	... Of no value unless attended with casts.
9. Duration	... 1 to 3 years	... From 10 months to as many years.
10. Progress	... Rapid	... Slow.
11. Complication	... Appear early	... Late.
12. Coma	... Rare	... About 60 per cent. and only in the advanced stage of the disease.
13. Loss of virile power ...	Late	... Early.
14. Knee-jerk	... Late and rare	... Early and common.

Prophylactic treatment must be conducted on the general lines of hygienic of the body. Too much restriction of diet is followed by loss of appetite and impairment of power. Emotional disturbances are especially to be avoided. As regards diabetic treatment the author was of opinion that no restriction of diet was necessary when the patient passes only 100 grains in 24 hours. When this amount is exceeded, restriction is essential. Fish and meat cannot always be taken by Hindoo patients.

The skimmed milk treatment in the author's experience was extremely satisfactory. The use of curds, although an excellent article of diabetic treatment, was not regarded favourably. Saccharine was a most excellent substitute for sugar, but its use was beyond the means of many.

The author considered a change to a hill climate, as that of Darjeeling, of the very greatest benefit to Calcutta patients, provided suitable warm clothing was worn.

As regards drugs, antipyrine was found of great use by the author. The frequency of micturition was decreased, the skin moistened, and sound refreshing sleep was procured. It was contra-indicated if there was any suspicion of nephritis.

When there was much thirst and dryness of the mouth, pilocarpine, to the extent of half a grain per diem, in divided doses, was often of great value.

Opium was most beneficial if given by the mouth, but useless when given as morphia hypodermically. Confirmed opium-eaters derive little benefit from the medicinal exhibition of the drug.

Sulphonal as an hypnotic was often useful. Asafœtida, combined with nux-vomica in chronic cases, with the frequent symptom of a sense of sinking depression over the stomach, was most useful.

DIABETES.

BY A. MITRA, L.R.C.B., L.R.C.P.,
Kashmir.

It is not possible for me within the short space of time at my command to discuss, nor even to mention, the various ingenious theories that have been started in connection with the disease, the pathogeny and consequently the therapeutics of which are as yet very obscure to us in spite of life-long researches of such men as Claud Bernard and Pavy. The present position of our knowledge of diabetes has been very appropriately expressed by Sir Dyce Duckworth: "We better know what diabetes is not than what it is." Of the many debatable points connected with this disease, the following may engage our attention at present:—

(1.) What are the different forms of diabetes that are met with in India? In the Indian cases do we meet with two distinct forms of glycosuria as recognized in Europe, one a simple and another a grave form of the disease.

(2.) What is its pathology.

(3.) Is the disease more prevalent in India than before?

(4.) What influence age, race and profession have on the disease?

(5.) *Its Cause.*—Has it any connection with nervous strain, alcoholic drink, early or excessive sexual indulgence, excessive starchy and saccharine food, heavy brain work and bad nourishment, high thinking, and free living, as opposed to high thinking and plain living. Does gout or gouty diathesis predispose towards the disease? We can understand how in Europe highly nitrogenous food and wine produce gout, through what organ and how the pathological process is started, but we are unable to follow how ingestion of carbohydrates and saccharine food in default of well regulated muscular energy produce diabetes.

(6.) *Clinical Features.*—Does a case of diabetes run the same course and present the same symptoms in India as in Europe? Do we find here the acute glycosuria in the young and the chronic in those more advanced in life. Do we find in India cases of mild glycosuria amenable to modified diet? Are the classical symptoms, such as polyuria, thirst, burning sensation of the body, causalagia in the feet always present?

(7.) *Diet best suited.*—Is it advisable in a hot country like India to confine the diet entirely to albuminates and fats. A diabetic always retains a certain amount of power to metabolize carbohydrates and utilize sugar, and, if these articles of food are entirely cut off, does not his system suffer?

(8.) *Prognosis.*—Is diabetes curable! If sugar be detected in the urine does that life become unfit for insurance?

(9.) *Its Therapeutic Treatment.*—In the beginning of this year I published an advertisement for certain information connected with this disease from patients and medical men. The informations required were—

1. Age.
2. Sex.
3. Race.
4. Profession.
5. Age in which the disease was first noticed.
6. Family history. Any relative either in the paternal or maternal line suffering from the disease.
7. Married or not: if married at what age?
8. Children. How many children before the disease and how many after?
9. Habits: active or sedentary?
10. Intemperate, temperate or total abstainer?
11. Do you use any intoxicating drug?
12. Have you lost weight since you have suffered from the disease? Have you kept any record of your weight from time to time?
13. Do you perform excessive mental work?
14. Had you any source of grave anxiety or any serious mental grief or powerful emotional disturbance before the disease was first noticed?
15. Have you ever had any injury to the head, spine or or any other part of the body?
16. What was your usual diet before the disease was noticed?
17. Do you suffer from any other disease, if so what?
18. How did the disease first draw your attention, or how your suspicion was first raised that you were not healthy?
19. Average quantity of urine in 24 hours.
20. Present state of your urine if chemically analysed.
21. Do you suffer from thirst, burning sensation of the body, specially of the extremities, and sleeplessness?
22. What diet now suits you best? What diet does not suit you?
23. Have you tried skimmed milk or butter-milk?
24. What treatment you found most useful in your case? Have you tried (*a*) opium, (*b*) codeia, (*c*) jambul, (*d*) arsenic, if so with what results?
25. Did you ever try change of climate? What climate suits you best?
26. Have you complication, such as cataract, carbuncle, &c.?
27. Give briefly an account of your present state of health.

I received numerous replies and the information was very interesting. I regret that for want of time I am unable to give you a full analysis of the informations collected by me. I hope to present them to the profession at an early date, but now content myself in giving you a brief analysis of 200 cases.

2. SEX.—I have not received a history of any female patient. Two European patients say that their mother died of diabetes. I believe diabetes is extremely rare among females in India.

3. RACE.—My 200 cases are thus classified:—

Europeans	9
Eurasians	5
Hindus, Bengali	47
„ Madrassees	3
„ N.-W. P.	16
„ Punjabi	12
„ other parts of India	52
Mahomnedans, Bengali	9
„ Punjabis	13
„ other parts of India ...	12
Sikhs	2
Parsees	4
Christians, Bengali	5
„ Madrassee	1

4. PROFESSION.—The following shows the profession of 200 cases:—

Lawyers, including law officers	43
Medical men	18
Schoolmasters	7
Merchants	13
Engineers	3
Retired Government servants	3
Journalists	2
Mariner	1
No profession	90
Soldier	1
Clerks	19

In the majority of my cases the age in which the disease was first noticed was between 35 and 45. I have the history of one family in which the father, a diabetic, has two sons, one aged 30 and another 25, both of whom showed symptoms of diabetes at the ages of 20 and 17, respectively. In India we see a large number of cases of diabetes occurring in old age after 55. These cases usually run a mild course.

6. *Family history.*—Out of 200 cases, 95 give distinct history of heredity, in 12 no satisfactory answer was obtained, and in the remaining there is no history of diabetes in the family. In 8 cases there is history of a diabetic brother and not of diabetic parents. In two cases mothers died of diabetes. Six patients say that their father died from apoplexy. Four state that rheumatism is their family complaint. Three give history of phthisis in the family and four of syphilitic dyscrasia.

7. Married 188. Unmarried 12. Going over the ages in which marriages took place, I find not more than ten under 20.

8. In a large majority of cases one or two years after the onset of severe symptoms, power of procreation ceased. In mild cases sexual power was unimpaired and semen retained its fructifying power. Sexual power is uninjured in many cases, but the semen loses its potency. One patient says he had five children after the onset of the disease, and his case is by no means a mild one. In one case the sexual power is lost during increase of the symptoms of the disease, but it reappears on improvement of general health.

9. Many patients say that their habits are sedentary, and their number is large in comparison to those who

say that their habits are active. There are, however, some cases in which there is history of unusual active habits from early life.

10. Intemperate 4. Temperate 107. Total abstainer 89. It will be seen that total abstainers in India are by no means free from the disease. The line of demarcation between temperance and intemperance is no doubt often confused.

11. It appears that a large number of diabetics in India use opium, for they find temporary relief from the drug. With some, however, it does not agree at all. One patient says that even such a small quantity as about the size of a mustard seed produces flatulence, dyspepsia and headache. Out of 200 patients 69 use opium habitually, one of them taking 20 grains daily.

12. The majority of patients say that great emaciation and loss of weight followed the disease. In some, however, and their number very few, no marked emaciation followed. One patient says that his face and extremities are wasted, but his abdomen remains as obese as before. Dr. Beale, of Bombay, sends me a case, in which within 10 months 5st. were lost. Many patients say that they emaciate for some time, but whenthe polyuria diminishes, and with it the quantity of sugar, the lost weight is recovered. Several patients say they have been very stout. Many say that they have a tendency towards obesity.

13. Some say they have much mental work to perform. It is to be noted that two judicial officers say that whenever they have to perform any extra mental labour, such as writing a long judgment, the symptoms are aggravated. One official says that he is always bad after finishing his annual report, which entails much mental work.

14. Many patients fail to trace the disease to any grave mental anxiety, while 27 attribute their illness to family affliction, grave mental anxiety or grief or collapse of a lucrative business.

15. In two cases out of 200 there is history of injury on the head.

16. The majority of patients say that their usual diet before the disease was noticed was ordinary mixed diet; 12 patients say that they have been always strict vegetarians. None admit that they were exceptionally fond of sugar.

17. Various inter-current maladies are reported. Acid dyspepsia is a common complaint. Rheumatism, hæmorrhoids, phthisis pulmonalis, chronic bronchial asthma and other complaints are found in some diabetics; 12 patients are subject to malaria; 5 are gouty. Syphilis occurred in 6.

18. In one case the medical attendant says that the disease was first ushered in after a chill following a severe drenching in rain, which threw the whole body in a condition of aches and pains. This, with the unusual desire to keep on frequently micturating and an insatiable thirst with constant dryness of mouth and throut, made the patient to seek for medical aid, when sugar in the urine was found. In one case the disease appeared after an attack of remittent fever, and then became a confirmed malady. In three after acute rheumatic fever.

19. Polyuria is almost universally present. It is however conspicuous by its absence in 9 cases. The symptoms are usually intermittent. One patient says he passes 4 gallons of water daily.

20. The average quantity of sugar estimated is from 8 to 10 per cent. In India diabetics do not have their urine examined so often as they should, especially quantitatively. The specific gravity in nine cases appear to be below 1020. The highest is 1050. A trace of albumen is recorded in 12 instances, and most of these are patients of old age. The reaction is recorded acid in all cases.

21. Thirst, burning sensation of the body and sleeplessness are present more or less almost in every case.

22. Diabetics in India very rarely follow a strict diabetic regimen. In a tropical country it becomes almost impossible to restrict the diet entirely to meat and fat. In none of my cases I find a strict diet enforced or adopted. A Bengali usually cuts down his rice to a minimum and takes to wheat or bran. A Punjabi leaves off wheaten flour and takes to bran. A European takes to bran bread, but a strictly exclusive diet, as it is understood in Europe, is very seldom adopted in India. Many patients say that bread, wheaten or bran, do not agree with them; the former increases thirst and acidity, and the latter produces dyspepsia.

23. Skimmed milk was tried by 185 cases, but none appears to have followed strictly the instructions of Scott Donkin. Two patients speak very highly of it, but from the majority of cases in which it was tried, it appears that beyond assuaging thirst and perhaps relieving the burning sensation of the body, no other result follows its use. The large quantities of skimmed milk appears to act as a flushing agent just as large quantities of alkaline mineral water do.

24. No drug appears to have any appreciable value in a case of confirmed diabetes. Opium is given a trial by nearly every patient whose history I possess. There are some who speak very highly of it, while there are others who have found no relief from it. Codeia I find was tried in 120 cases out of 200, and the result is the same as with opiun. Jambul has been tried by a large number of patients with no definite result. In one patient the following was the result: "Jambul fruit 4 ozs. daily was begun when the urine measured 20 ounces, sp. gravity 1044, sugar 10 to 15 grains per ounce. After three days it was noticed that the urine still measured 20 ounces, sp. gravity 1028, sugar 2 to 3 grains per ounce. Two days later the sugar fell to 1 to 2 grains per ounce, and the quantity of urine rose to 29 ounces with sp. gravity 1026. Nine days after the jambul fruit was begun, the amount of sugar registered 6 to 7½ grains per ounce, so jambul seeds in powder ten grains thrice daily were given in addition to the fruit. About this time the urine measured 120 ounces, sp. gravity 1042, sugar 10 to 15 grains per ounce. Weight now was 5st. 13lbs., the original weight of the patient being 11st. 2lbs.

In 23 cases arsenic was tried with scarcely any appreciable result. In all such cases however temporary benefit was obtained by the use of the drug. Alkalies and alkaline mineral waters are highly spoken of by those who have used them. Bromides of arsenic, soda, potash, and lithia, antipyrin, sulphonal, salicylic acid, salol, pancreatic emulsion, raw pancreas, were the other remedial agents used with scarcely any marked improvement. One or two patients highly extol drugs prescribed by Ayurvedic physicians, one patient saying that he derived great benefit from the burnt ash of *sundri* wood.

25. Climate seems to have no influence on the disease itself, but all patients who tried change of climate derived benefit from it. It improves the general health, and with such improvement, the symptoms disappear. Summer sojourn in a cooler climate proved of great benefit to several patients. Sea was tried by four patients, who say that it produced remarkably good result on their general health, one going so far as to say that it snatched him away from the jaws of death.

26. Skin diseases, boils, carbuncles are complications in many cases ; 107 cases give history of boils ; 12 cases have cataract ; 17 have impaired visions, which may also be due to cataract ; cardiac weakness is complained of by two cases. Two patients say that their skin keeps peeling off. Erythema on the hands and feet occur in four cases. One patient has eczema. Constipation is the usual complaint. In three cases œdema of the feet and hand are present. Vomiting is a troublesome complaint in one case and diarrhœa in four.

DIABETES MELLITUS.

BY BABU BAMON DAS SEN, L.M.S.

In a paper on diabetes mellitus Babu Bamon Das Sen raised the question of the influence of heredity, neuralgic headache, rheumatism, and early suppression of the menses in the production of diabetes mellitus; also as to whether a wife can contract it from a diabetic husband.

These factors existed in several cases under his care. In four other cases his patients had long-standing gonorrhœa and were addicted to excessive venery.

A burning sensation all over the body was a distressing symptom in some cases.

In discussing the treatment he alluded to the difficulty of preventing the natives of Bengal, especially females, from eating starchy and saccharine foods and in inducing them to eat meat ; and said that on resuming rice as a food the previous improvement in the condition of the patient disappears to a great extent. He recommended that opiates and codeia should after a time be discontinued (to be resumed later) on account of their toxic effects, and had found iron, arsenic and strychnine useful.

DISCUSSION.

E. S. K. Aiyer (Mysore) said that Bunge in his work on physiological and pathological chemistry stated that the sugar in the urine of diabetics was dextro-rotatory, and that a diabetic was able to assimilate lævo-rotatory sugar. One patient who lived exclusively on *fruits* had no sugar in his urine. The urine was examined, and not even half a grain of sugar could be found in the urine of 24 hours. The urine continued free so long as the patient remained on fruits, but the moment he took his ordinary diet of rice and vegetables, sugar re-appeared in his urine. Fruits, except grapes, contain fruit sugar, which is invert-sugar. This invert-sugar is lævo-rotatory. To judge from the experience of this one case it is quite possible for one to live on the ordinary Indian fruits. It is worth while trying fruit diet in diabetes.

Churamani (Allahabad) said he had been a diabetic himself since the last eleven years. He had met with patients who had died within a few months, and others who had had it for 25 years and upwards. During the last eleven years he had lost 46lbs. in weight. He thought the chronic form the most common in India, and the main cause to be sedentary life with little or no physical exercise. Those using animal food are little liable to it, and vegetarians, especially if fat and bulky, much more so. Hence its less frequeucy among Musulmans than among orthodox Hindus. Skimmed milk had proved very successful in his own case, but relapse occurred on returning to ordinary diet. He had derived much relief from a pill of phosphate of iron, extract of nux vomica, ergotine and morphia three times a day ; also from the Vaidic treatment by chandrodaya and other drugs. He did not think a wife could contract the disease from her husband.

B. C. Sen (Calcutta) said : *1st*, that as regarded infant marriage being a cause of diabetes, it was not only that but the cause of many other diseases also. Could a vigorous tree be expected from a miniature seed ? He believed it accounted for the bad physique of the Bengali. *2ndly*, that the present system of education was unsuited to the country, and that when in his childhood and youth he heard of one diabetic now he found one or more in every family. He could not get hold of any statistics before the establishment of the Calcutta University. Change of air to the hills sometimes did good, but he knew of cases where it had a pernicious effect. Total abstinence from alcoholic liquor was no safeguard against its onset. Exclusive meat and fat diet was generally unsuited to the people of India, considering their habits and climate. He fully agreed with Dr. Bose that starchy and saccharine food did not induce diabetes—the Chowbeys of Muttra and the Indian coolies of Mauritius are living examples.

The President said that Dr. Mitra's paper must be regarded as a distinct contribution to our knowledge of diabetes as it occurs in this country. Dr. Mitra deserved much praise for the trouble he had taken to obtain precise information on the various points on which knowledge was before hazy and ill-defined. As regards the causation and prevalence of diabetes in India the President was accustomed to regard and speak of diabetes as the gout of the Hindus, meaning by the expression that diabetes bears the same relation to the diet and habits of the people of India which gout does to those of the people of northern climates—that is to say that as gout occurs in meat-eating races chiefly among those who indulge in such food beyond the requirements of the system, and especially among those who have to work hard with their brains rather than with their hands, so diabetes is especially common in people whose diet consists largely of farinaceous and saccharine elements among those who indulge in these articles of diet beyond the requirements of the system. Diabetes is especially common among those whose occupations are sedentary, and entail an unusual expenditure of brain power, *e.g.*, among native members of the Judicial Department.

DISCUSSION ON FILARIA MEDINENSIS.

(See page 118.)

C. Banks (Puri) had only seen one case of guinea worm. The patient was a boy coolie on a coffee estate in Santa Coorg, Mysore. The disease was confined to the lower extremity near the ankle, though the knee joint was inflamed as well. Attempts were made to remove it by means of the old-fashioned treatment of rolling it round a quill. The boy did not remain under treatment. The disease was accompanied by intense pain, specially felt on attempts at extraction.

H. Thornhill (Ceylon) said that guinea worm was very frequently met with formerly amongst the coolies on coffee estates in Ceylon. They had come from the Madras Presidency. Of late years it had seldom been met with, in fact it was now rarely, if ever, seen. In one instance that proved fatal he had found it in the walls of the abdomen. He could not recall whether he had met with any cases in women or not.

J. Chaytor White (Mirzapur) said that sepoys in the Meywar Bhil Corps suffered much from filaria medinensis. About 35 per cent of all males in Meywar suffered from this disease. Females were rarely affected. He had seen as many as eight worms extruding from the buttock of a man, but usually only one was extruded. The treatment was the usual one of rolling round a stick. He had not tried the perchloride treatment. He believed the drinking water to be the cause of infection.

L. J. Pisani (Jaunpur) a few years ago had had the opportunity of treating several cases on the Punjab Frontier, and had tried the application of weight extension with good effect. The weight required was a small one, one or two drams, or thereabouts, depending on the thickness of the worm. In later cases a combination of this method with the older one of winding the worm on a piece of stick was tried with better results, as the extruded portion of the worm had less tendency to dry and break. It was surprising to find how effectually the animal came out under this treatment. The patient who could watch the rapid effect of the treatment as compared with previous methods took an interest in carrying it out. He had described this method in the *British Medical Journal* a few years ago, but had seen no cases of guinea worm since the perchloride treatment had been introduced.

E. A. W. Hall (Purulia) had seen three cases in sowars of 2nd B. L. at Saugor. They occurred within three months of each other, and there were no other cases while he was with the Regiment. In one case four abscesses occurred above and below the knee, and he removed three worms from the abscess. Treatment was by rolling off.

TYPHUS FEVER IN HOTI MARDAN AND IN BALUCHISTAN.

BY L. J. PISANI,
Surgeon-Captain, I. M. S.

I PROPOSE to bring before you a brief account of two outbreaks of typhus fever which I have observed in two different parts of India, namely, in the Peshawar District in 1888 and in Baluchistan in 1891. Typhus fever is no new disease in India. Anybody who has had occasion to refer to Dr. Bryden's Statistical Report, published in 1878, will, I think, feel convinced that some, at any rate, of the outbreaks described by him were instances of true typhus. In discussing the mortality from this disease which decimated many of the jails of India between 1859 and 1867 Dr. Bryden says : "It is in the interest of those to come after us that the teaching of these nine years should be recorded. * * * I have given so prominent a place to this epidemic contagious fever of 1859 to 1867, * * because I know that the very same objections and doubts will certainly be brought up again and lead to not less disastrous consequences than have followed the assertion of erroneous individual opinions in our time." The improved sanitary condition of our jails in recent years has led to the disease being less frequently observed, to our forgetting the work of our predecessors, and to our doubting even the prevalence of typhus in India. I think that we have accumulated evidence to show that typhus is endemic in certain parts of India where climatic conditions in some seasons of the year approach to those of European countries. In fact we might call this an endemic area, and include in this area the trans-Indus Districts from Beluchistan to Eusufzai, the Hazara and Rawalpindi Districts and the Himalayan Hill Tracts.

The first of the two outbreaks which I will bring to your notice occurred in the Magistrate's lock-up at Hoti Mardan in the Peshawar District during the months of April, May and June 1888. There had been a good deal of sickness, accompanied with mortality, during the month of April, which the Hospital Assistant in charge reported to be remittent fever. During the month of May I was asked to enquire into the sickness, and during this month and in June I had an opportunity of observing eight cases of typhus, one being abortive, among the N. T. prisoners, and two cases among the constables, who had formed part of the guard over the sick prisoners at the Murdan Dispensary. I shall exclude the abortive case, and read the few notes that I possess of the other cases :—

Case 1.—Admitted 7th day of illness ; seen on morning of 8th day commencing rash over abdomen, delirious ; 11th day rash extensive over side of chest and abdomen, semi-conscious ; 14th day temperature normal, rash dark purple ; 15th rash still present, I have no note when rash disappeared ; 18th day conscious for first time ; 20th day of illness appears deaf ; 23rd still deaf, constipation throughout.

Case 2.—Seen on 8th day, was then delirious, semi-comatose slight, commencing rash ; 11th day rash evident, but scanty on side of abdomen and chest of purple colour ; 14th day temperature normal ; 15th day rash disappeared ; 17th to 20th day troubled by vomiting ; 22nd day apparently deaf, constipation throughout.

Case 3.—Seen 6th day ; 7th day two suspicious spots on abdomen, no delirium ; 13th day evidence of pneumonia ; 14th day spots petechial ; 16th delirium, abdomen distended, hiccup ; 17th temperature normal.

Case 4.—Seen 5th day ; 11th day slight delirium ; 12th day more delirious, semi-conscious ; 13th day purple mottling over abdomen and chest ; 14th day temperature normal, offensive black stool ; 15th day delirious ; 16th day no delirium ; 18th day some petechiæ visible ; 21st day deaf.

Case 5.—Seen on 2nd day ; rash commenced on 6th day ; was well marked by 10th day, slightly delirious ; on 13th day unconscious ; on 15th day temperature normal ; on 18th day deaf.

Case 6.—Seen 1st day ; rash commenced on 9th day ; 11th day delirious, semi-conscious, macular rash purple, extensive over side of abdomen, over chest and spreading over the arms ; 14th day pneumonia, rash still present ; 19th day temperature normal.

Case 7.—Police constable on guard over sick ; seen 1st day, suspicious looking spots ; on 4th day soon disappeared ; 6th day epistaxis ; no note of delirium ; temperature normal 14th day.

Case 8.—Seen 1st day, signs of rash ; on 5th day still present ; on 8th day scanty ; no note of delirium ; temperature normal 14th day.

Case 9.—Police constable seen 6th day ; had been on duty over sick and been relieved ; when first seen he was covered with a macular purple rash ; this rash was so extensive that it extended pretty nearly all over the body, except his face, at first of a bright purple, it became gradually darker. He was delirious, semi-conscious. This man died on the 10th day of his illness.

In the brief notes that I have given you will see that the pyrexia in the non-fatal cases lasted from 14th to 19th day ; it was of a continued type throughout ; the fever was accompanied by a distinct measly purple rash, very extensive in cases 6 and 9, evident in cases 1 and 5 and in 3 when the mottling subsided. Scanty in 2 and 3, and practically absent in case 7. The rash commenced in one case on 5th day, in one on 6th day, in one on 7th day, and in one on 9th day. In all these cases there was an opportunity of observing the cases previously to the days mentioned. In three cases the rash was present, when the patients were first seen, one on the 6th and two on the 8th day. In the case where mottling was noted it appeared to have occurred unusually late, namely, the 13th day ; at any rate I have no notes of its being visible anterior to this date. Delirium of a low kind was present in 7 out of the 9 cases, accompanied in many of the cases by great prostration, and more or less unconsciousness. In two cases there was pneumonia occurring on the 13th or 14th day of the disease, and in every other case there was more or less signs of bronchitis. Sir George Buchanan, in his article on Typhus Fever in Reynold's System of Medicine, says, that "symptoms referrable to the respiratory system are so common and so important that they must be regarded as essential parts of the disease." In every case, both in this outbreak and in the cases I shall relate presently, the frequency of these respiratory complications constituted an additional danger to the disease. Constipation was a marked feature in most cases ; marked tympanitis was present in three cases ; troublesome vomiting during convalescence in one case. In four cases there was marked deafness lasting for some time during convalescence, and in the case of the constable, where there was no rash, there was epistaxis on 6th day, about the period a rash would be expected.

Having given a short history of the cases, I propose to discuss the evidence of contagiousness of this fever. We have—

(1.) The evidence that two constables on guard over the prisoners contracted the disease, one dying.

(2.) The importation of the disease to the Peshawar Jail. It was due to some prisoners suffering from fever, having been transferred from the Mardan lock-up on 28th April to Peshawar that led to the civil authorities, at the request of the Inspector-General of Prisons, Punjab, to ask me to enquire into the sickness prevailing at the lock-up. I reported the disease to be typhus fever on 2nd June 1888.

The following extract from the report of Sanitary Commissioner for the Government of India for 1888, extracted from the report of Inspector-General, Punjab, will give further information on this point :—

"There can be no doubt as to the outbreak of typhus, or a fever allied to typhus, in the Peshawar Jail. It is believed by the M. O. to have been imported into the jail by a gang of sixteen prisoners transferred from the Mardan lock-up on 28th April. * * * At first the M. O. regarded the fever as being of a remittent type, but after further observation he came to the conclusion that the type more nearly resembled that of typhus than any other fever. * * * * * * * With the exception of the prisoners transferred from Mardan lock-up, very few were attacked ; one was a hospital attendant in whom the disease was fatal ; the disease disappeared in June. * * I regret to have to report the occurrence of a more severe outbreak in the Peshawar Jail in the current year (1889.) It began towards the end of February. * * The admissions have been much more numerous, 47 in all with a mortality of 7. The Jailor contracted the disease and fell a victim to it."

From the above you will, I think, agree with me in saying that the disease in the Peshawar Jail was one and the same disease which prevailed in the Mardan lock-up ; that the fever was of a contagious character; that, as is common in typhus, the sickness disappeared in the summer to again recrudesce on the advent of a subsequent winter. At the time that the sickness commenced in the lock-up, and for some time before, there had been considerable over-crowding ; the barracks were very badly ventilated, the only means of ventilation being through the grated doors ; in addition, the barracks themselves were in a very insanitary condition.

As typhus is endemic in the Peshawar District, and the history of the earlier cases not obtainable, the origin of the outbreak could not be traced.

The second group of cases that I will bring to your notice occurred among the coolies working in the Khojak Tunnel in Beluchistan. I cannot give you an account of how and when the disease commenced, as the early history of the sickness in the Khojak was involved in obscurity. During the winter of 1890-91 there was an excessively fatal disease prevailing among the coolies, as you can judge when I tell you that from 1st November 1890 to 31st March 1891 no less than 800 coolies are computed to have died. Evidence of a very fatal contagious disease was obtainable from the excessive mortality among the hospital establishment, while in 1888 and 1889 there was only one death each year at the Headquarter Hospital at Shalabagh. In 1890, out of a strength of nine, seven died, the mortality among the dressers, who distributed medicines to the patients, being no less than 200 per cent. In the first seven months of 1891, out of a strength of ten, four died.

The cases which I found prevailing after my arrival on 19th April were cases of relapsing fever, a few cases of typhus fever, and some cases which did not present any characteristic features. It is with the cases of typhus that I propose to deal.

I shall give an account of the seven cases which I saw ; they occurred like the Hoti Mardan cases in the months of April, May and June.

Case 1.—Admitted 23rd April ; 6th day, seen ; on 7th day lying on back groaning and prostrate. Sordes on lips, purple rash not raised over abdomen and lower and front part of chest ; bronchitis both lungs, spleen tender ; 8th day, delirious ; 10th, delirium, now of active character ; 11th, disappeared from hospital during night, again brought back in the morning looking much worse ; 13th, delirium, active signs of pneumonia ; 16th day, temperature normal, complained of cardiac pain, getting more prostrate ; died 17th day. Post mortem examination, rash still, faintly marked signs of double pneumonia, pericarditis and meningitis, enlarged spleen and liver, temperature irregular.

Case 2.—Hospital dresser taken ill ; 21st April, admitted ; 23rd, kept in his room, informed of his illness ; 9th day, he was covered with a very copious and a very marked measly rash present over chest and sides of abdomen, and some on thigh and arms ; on 11th day, crepitant râles, both lungs resonance, impaired; 13th day, delirious, tongue protruded with difficulty, rash getting darker; 15th day, prostrate, during the night had epileptic convulsion, and died ; rash present after death.

Case 3.—Assistant-Surgeon taken ill ; 28th April, irregular temperature, rash appeared ; 8th day, slightly raised at first, signs of bronchitis; on 11th day, the following note of the rash was made—it is dark purple, situated at sides of abdomen, the lower part of the sides and a few in front of chest; a few spots on flexor surface of the forearms, delirium began late ; on 18th day, had lobular pneumonia and laryngitis, temperature normal; 22nd day, delirious up to 25th day ; rash practically disappeared on 18th day.

Case 4.—Admitted 12th day of illness ; seen on 13th day, very prostrate, breath foul, can scarcely protrude his tongue, intellect dull, passing motions in bed, purple rash over chest and abdomen accompanied by mottling, bronchial rales back of both lungs, resonance not clear ; temperature normal 15th day ; 16th day rash and mottling disappeared.

Case 5.—Admitted 6th day of illness, rash present, purplish red ; 8th day, rash darker, disappearing on pressure, cough ; 10th day, very drowsy, sordes in teeth, cannot protrude tongue ; 11th, passing watery motions in bed, prostration marked, bronchial rales ; 12th day, delirious, temperature normal ; 16th day, convalescent, rash faintly seen.

Case 6.—A recent arrival at Khojak seen from 1st day ; 4th day, sign of spots of reddish colour over front and sides of chest, abdomen, and back not elevated ; 5th day, bronchitis ; 6th day rash, now well marked and of a purple colour disappearing on pressure; 8th, rash does not disappear on pressure; 14th day, temperature normal, rash hazy; 26th day, rash very faintly visible, no delirium.

Case 7.—No clear history of illness ; admitted 12th June, very dull ; tongue dry, brown and black, in centre reddish purple, rash and mottling over chest and sides of abdomen and flexor surface of forearms; June 13th, vomited; June 14th, vomited six times; 15th, delirious at times, rash dark purple, does not disappear on pressure ; June 18th, temperature normal; rash disappearing ; 19th, rash nearly gone.

Some of these cases were not typical, but taking all the symptoms together and the presence of the characteristic rash, I think removes all doubts of the nature of the disease.

From obvious reasons evidence of contagion could not be established in all the cases.

TYPHUS FEVER IN BALUCHISTAN.

BY W. VOST, M.B.,
Surgeon-Captain, I. M. S.

I BECAME well acquainted with this fever when resident in the Belvedere Hospital at Glasgow, and since then I am convinced, from what I have seen and heard, the same disease exists in some of the hilly districts of the North West Frontier of India, and spreads, as in the British Isles, under similar conditions of over-crowding, imperfect ventilation, and personal uncleanliness. While medical officer of the Mushkaf-Bolan State Railway in Baluchistan, I recorded at Hirok, with the help of a hospital assistant, the temperatures of eighteen cases, and from notes taken at that time, the winter of 1892-93, will give a few particulars of the disease as seen there, and of the conditions under which those attacked had lived.

The cooly population employed on the construction of this railway was drawn almost entirely from trans-frontier Mussalman races, so it was not a surprise that those affected were mainly Ghilzais, and men from Jelallabad in the Khyber direction, who together formed a considerable proportion of all.

Two Hindus only were attacked to my knowledge. One from the Punjab had been under treatment several weeks for simple fracture of the thigh, and in hospital lay opposite a Pathan, at first supposed almost better of intermittent fever, but afterwards believed really to have had typhus fever before admission. No other in the same ward could be recollected as at all suspicious and likely to have brought the disease there. Every endeavour had been taken to isolate known and doubtful cases. His chart is interesting in shewing the course of the fever as early as the second day. I have no record stating from whom the other Hindu might have contracted his illness.

The first case came under observation on 9th December, and the last on 5th April. In January and

February, particularly the latter month, most were seen,—that is, during the months that bitterly cold wind sweeps down the Bolan Pass, and at night men crowd together in tents or under bridges to keep themselves warm. Those borders of the tents resting on the ground, I found, were for the same reason banked with earth, and the open ends of stone bridges closed by canvas matting and old clothing. Thus ventilation was almost nil, and under the bridges very little light could enter. The only defect in their food was insufficiency of vegetables. Being well paid, they could buy good food, and usually did, but vegetables were scarce and difficult to be had. Several were attacked while snow was lying on the ground. Those who know Pathan labourers will readily believe they seldom or never wash either themselves or their clothes. Donkeys, much used in connection with their work, at night were often huddled together with the men.

Once the disease made its appearance, it was a wonder it did not spread more than it did. I have no doubt cases escaped detection by the sanitary inspectors. Several of those discovered ill had worked till they could hold out no longer, and on one occasion, snow hindering work of any kind, three were found in a crowded tent in which another had just died of typhus. One of these lived less than a week afterwards. Had it not been usual to inquire into the cause of every death, these cases might not have been discovered.

The period of incubation, and from whence the disease was originally introduced, were never ascertained.

Of those that came in contact with the sick in hospital, three were attacked, *viz.*, the Punjabi Hindu with fracture, the second a sick attendant on his father ill of the disease, and the third my hospital assistant.

The last, a Peshawari Pathan, was the only instance in which I was able to detect a rash, though I made a point of examining all with care. It affected the same parts seen in British cases, seemed of a somewhat lighter shade, consisted of smaller blotches, that afterwards became fixed, and was unlike measles in that none was noticed on the face, and it nowhere appeared to be raised above the skin. The smell from those I have seen did not attract my attention to the same degree that cases in Scotland had. Typhoid symptoms were frequent in severe attacks. None appeared at all like enteric fever in having symptoms referable to the bowels. Ague was not prevalent at the time, or remittent fever.

The temperature of the single case observed from the beginning was found to mount steadily for the first four days, the morning fever exceeding that of the night before. The maximum temperature was usually first reached in the early days of the second week, and the fever began to descend on the thirteenth, fourteenth, or fifteenth day—generally from the fourteenth day. In a few instances there was a distinct crisis, but lysis was the more usual form of termination. In a few the fever lasted two or three days over the expected time. This may have been from it not being always easy to get a clear history.

The temperature usually varied between 102° and 104·5° F. after the first four days. In one patient only did it reach as high as 104·8° F. He had no complication, and had had sulphate of cinchonidine given him for some time. Without exception the temperature fell several degrees before death, and at times the drop was very marked.

Among the eighteen attacked and treated in hospital, five deaths occurred: 27·7 is a high death-rate.

Death took place on the eleventh, twelfth, thirteenth, sixteenth, and twenty-first days of illness. The one that died on the twenty-first day, I note, had no discoverable complication.

Complications had extremely little to do with the cause of death; for I find one only of those that died had his sickness complicated, and this one by a trivial attack of bronchitis. The severity of the disease alone exhausted them.

Complications were more frequent among the thirteen that recovered, three having had as well a mild attack of pneumonia, one dysentery, and one diarrhœa. No treatment cut short the attack.

I present some of the charts of those who were under my care, and trust this paper may help to dissipate to a certain extent the doubt expressed by some of there ever having been typhus in India.

TYPHUS FEVER IN INDIA.

BY H. HENDLEY, D.P.H., (CAMB.)
Surgeon-Captain, I. M. S.

Introductory.—Whether typhus fever is one of the many diseases we have to fight against in India, is a question that has often been asked, and, though we in the Punjab have no hesitation in answering in the affirmative, our assertion is met with doubtful questioning elsewhere.

Cayley, in the 1884 edition of Murchison, sums up in favour of its having been observed in Punjaub jails, but still in such a manner as to be unconvincing to the sceptical.

Much of this doubt was probably due to the fact that earlier references to supposed typhus in India lacked one almost essential feature, namely, a description of any kind of rash, at the same time they were apparently conclusive from a superficial point of view in that the fever was of a continued type, strongly believed to be contagious, and had a very high rate of mortality. Viewed in the light of my own experience, it does not seem possible that the early epidemics of a continued fever described by Drs. Lyell and Farquhar in Yasufzai and Wallick in Kohat, in the "India Annals of Medical Science, 1852-53," could have been accompanied by a rash; for, in the large number of cases seen, it must have been discovered in some. Later, however, in 1863-64, cases observed by Drs. R. Gray and De Renzy were described as typhus, but again no rash was observed. In 1869 Dr. Fairweather described a rash identical with that of typhus in cases in the Rawalpindi jail, and since then it has been observed again and again by medical officers of the Peshawar jail.

Some observers have maintained that the rash has not been identified in natives of India, owing to their deeply pigmented skins, whilst others point to the fact that the rash is not always appreciable in many cases, in undoubted epidemics of the disease in Europe.

Both Morehead and Murchison are rather in favour of considering these rash-wanting epidemics of continued fever as adynamic forms of malarial fever—the fever assuming an adynamic condition and becoming infectious and contagious in consequence of overcrowding and neglect.

This is not unlikely, as the epidemics described by Drs. Gray and De Renzy in the Punjaub, commenced by being first intermittent, and then successively assuming a remittent, and finally a continued character.

It is easier to establish the fact of the prevalence of typhus from year to year in the Punjaub than to prove that this infectious adynamic form of malarial fever is distinct, or that the one merges into the other.

Epidemics in Peshawar.—For example, in the epidemics of typhus in the Peshawar Valley, 1891-92, the distinguishing features of the disease were unmistakably marked in the majority of cases seen. I have kept notes of fifty-three of these, and to them my remarks principally refer.

In 1891, during the early months of the cold season, there was comparatively little fever of a malarial type in the district, but during the months of March, April and May, the mortality under the head of "fevers" became very high.

Localities affected.—The villages first and throughout principally attacked were on non-irrigated and high-lying ground, overlooking the valley, such as were not usually affected by malarial fever, and where those situated on low-lying and irrigated ground were attacked, direct infection from the former villages could often be traced. For instance, take the village of Jalogai. Dass Mull contracted the disease in Daghi Ismail Khel—a village situated on a spur of the hills to the south of the valley, and where the disease was rife amongst people who were strong, muscular and employed in the open or high-lying, non-malarious ground. With the infection on him he went to Jalogai in the plain, and from him the disease quickly spread, first to his brother, and then to others.

General information was not wanting as regards similarly situated districts outside our own territory. Reports of the prevalence of the disease in Cabul and the intervening hills were constantly heard during the whole of the cold weather, and as traffic became freer towards the spring, the infection spread to the valleys below.

Overcrowding.—Overcrowding formed an important factor in the spread and virulence of the disease, as the following extract from my report, written at the time, amply proves :—

"It would be impossible to imagine a more perfect home for typhus than that offered by the people of this valley. Their one-roomed houses, say, 20 feet × 25 feet and 6 feet, built to keep out the cold, are low and dark, with not a vestige of ventilation, and no exit, except the one door which is made to resist thieves and draughts. Within, all through the winter, are agricultural implements, all the goods and chattels of the master, half-a-dozen head of cattle, probably the same number of people."

This overcrowding is more marked and more dangerous in the cold weather in the larger villages as well as in the city of Peshawar itself, owing to the numerous nomadic population, which at this time descends into the valley for trade and work.

Communicability.—In the villages the disease was never confined to isolated cases; it was found in clumps in each village, as though it had spread from distinct foci. As a rule, the history of its spread was easily traced, one member of a family infecting the others, and then these again their most intimate neighbours—instance the case of Sergeant Yassen. This man was stationed in the village of Taru, in an infected area. Admitted to hospital, he was visited on the sixth day of his illness by Augar Gul of Zakhi, a village in a non-infected area. Augar Gul contracted typhus and was followed on the sixth day of his illness by Majadin, on the eighth day by Oamrag, and on the twentieth day by Ahmed Ali, members of the same family, all of whom died. Again in Dagh Ismail Khel, all those first attacked lived in the same compound—Amir, his wife, brother and niece and her son—three deaths resulting. Nor are these isolated instances, for all through the epidemic similar cases were constantly occurring.

A convict was admitted to the Peshawar jail, suffering from continued fever, and on enquiry it was found he had shortly before been in the company of a man similarly affected. A rash appeared on the third day, and although from then to his recovery he was isolated in a shed open on all sides to the free passage of air, both his sick attendants suffered. The original case fortunately recovering sufficiently to nurse the last one attacked. There were no other cases in the jail, but one of the most zealous of the medical subordinates employed on special duty, connected with the disease, contracted it at this time and died.

Treatment.—Fortunately the most essential part of the treatment of typhus is also that which minimises the risk of its spread, *viz.*, plenty of fresh air. All patients were treated as much in the open as possible, and medical subordinates had strict orders, for their own sakes, not to examine patients in their insanitary huts. Nourishment, generally in the shape of milk, and stimulants when called for, with tepid sponging to reduce the temperature, were the main lines on which treatment otherwise depended.

Incubation.—The period of incubation seemed to vary considerably. In the more severe cases it was short, five to seven days ; in those less so, somewhat longer. There would seem, indeed, to be some relation between the dose of poison received and the period during which it remained in abeyance in the body.

Rash.—In nine out of the fifty-three cases I have notes of, the rash is not mentioned. The day on which the rash was first defined in all other cases depended somewhat upon the opportunities given for observation, but the average came to 6·8—in the majority of cases, though it was observed on the fifth or sixth day. In a large number of cases the rash was not noticed by the friends, until their attention was drawn to it.

To the skilled observer it was well marked, as a rule, after the sight had become accustomed to the lights and shades of the pigmented skin.

In the fairer Pathans the rash was very distinct, and friends readily noticed it from the first. Patients were always examined in the open, but even then, owing to the colour of the skin, it was often doubtful at the first visit if a rash were present or not. Towards the twelfth day, when the rash became a more decided red, or later petechial in character, there was little difficulty.

In the fatal cases there was a great tendency for the petechial spots to merge into patches, and when this occurred, the friends, from previous experience, argued a speedy ending.

The rash was confined to the chest, abdomen and inner sides of the arms, being especially well marked below the axilla. At least two cases were seen, in which it was definitely made out there was no rash. The subjects suffered from continued fever and subacute pneumonia, and their sick attendants contracted undoubted typhus. In the case of one, Jumma, the rash described on the eighth day was as follows : " A well marked rash on the arms, back, sides and front of chest and upper part of abdomen; it appears in small, round, brick red, apparently slightly raised, and in small reddish brown patches (mottling), not raised, and which partly disappear on pressure. The rash is, in some respects, like that present in measles, but there is none on the face, and there is no tendency to a crescentic form. "

Nervous Conditions.—The injury sustained by the nervous system was without doubt, in most cases, quite inadequately accounted for by the high fever. It was noticeable in the jail cases, even before the fever commenced, in a certain ill-defined indecision and listlessness in the expression, that could not be expressed by the terms ‘ out of sorts,’ ‘ seedy,’ &c.

After the first few days of the fever the listlessness became pronounced, the voice weak and then quite lost, the tongue trembled and subsultus tendinæ was marked in all fatal cases. Often, though quite conscious, the difficulty in recollecting their thoughts towards the end of the second week was insurmountable. When the temperature became normal the loss of muscular control was so extreme that in some cases the sufferers were believed by their friends to have palsy.

Temperature.—The temperature rose generally within the first 48 hours to 102° or 103°, and by the fifth day would be 104° or 105°, varying from $\frac{1}{2}$ to 1 degree during the 24 hours. In the case of the convict Amir Khan Mahomed, sick attendant, no very marked rise of temperature occurred till the fifth day of feeling ill, the rash appearing on the sixth. On the day the rash appeared there would be a fall of two degrees as a rule, and in the favourable cases, though it would again ascend and remain of a continued type, it would probably not rise to the same height as before.

Recovery.—Recovery in most of the cases was by crisis, occurring generally on the fourteenth, but if not then, on or about the twenty-first day. In the fatal cases death occurred from the seventh to the fifteenth day. When as early as the seventh the fatal issue appeared to be from a direct shock to the nervous system as from a specific poison more than from a high temperature.

A goodly number of cases died as late or later than the thirtieth day, but these must be put down to want of proper nourishment, or, perhaps, more correctly speaking, to insufficient nursing, thereby causing a relapse.

General Symptoms.—The conjunctivæ were invariably suffused after the first three or four days and remained so till the end. There was no coryza. The tongue became thickly coated at an early stage and then dry and markedly fissured. Early in the year some cases were complicated with sub-acute pneumonia, and others with simple congestion, both lungs being affected in each instance. The bowels were either constipated or fairly regular. A more than accidental appearance of diarrhœa was never noticed.

Post mortems.—Post-mortems made in the case of men who died in jail in 1893 were more interesting from the negative evidence yielded as to other diseases than from any distinct lesion found. The pericardium contained 2 ounces or more of serous fluid, the liver was much congested, the spleen congested and friable; in the cranium under the dura mater was a considerable collection of serous fluid, and the substance of the brain was markedly injected.

Endemic in Himalayas.—Typhus appears to be now endemic in the Himalayas, and the colder the season, the greater its virulence, and the more extensive will be its spread into the valleys.

Given a mild winter, the chances are that the valleys will escape infection, as then the disease will not have taken sufficient hold of the people of the higher altitude to become widespread, before returning hot weather, finds the people of the plains living almost entirely in the open.

It is very doubtful to what extent the typhus germ can survive and spread in a hot climate, but the disease has been known in Peshawar in the middle of May. It must be confessed, however, that out of the last 15 years, though it has been introduced into the Peshawar jail nine times in separate years, no case has occurred later than the 20th of May, and the epidemics have almost invariably ended early in this month or late in April.

Epidemic in Kulu.—A wet season also has the effect of increasing the spreading of typhus. The people are kept within doors and crops fail. This year, for this reason, the spread of typhus in Plach or Upper Kulu has been unprecedented. Within the last three months, 626 persons have been carried off in these sparsely-populated districts from this disease alone.* Lower Kulu has only had a few cases, two of which I have seen just lately.

One I saw on the 12th day had a well-marked brick-red rash on the back. The patient was the last of nine to get it, all being of one family, but living in two distinct houses. The wife of the eldest son was the first to suffer about 12 days after the return of her husband from Suraj (Plach), through which he had passed after carrying a load of apples to Simla. The remainder of the family followed. These people lived in dark crowded, lean-to huts, built on two larger houses, and were certainly much overcrowded. In Kulu and the neighbouring valleys the people are well aware of the contagious nature of the disease —their name for it is chimeri from chimar jana—to be contagious. Other names are khurmandi and bucheri, the one referring to the loss of hair that follows the disease, the other to populations being cleared off like close-cropped pastures after grazing.

As far as possible the villagers themselves now isolate families and avoid villages suffering from the disease.

Typhus and Malarial Fevers.—Here it will be seen we have a distinct disease. Is it possible that it can be developed *de novo* from malarial fever?

That the epidemics in the case of Peshawar had no connection with malarial fevers is evident:—

(*a*) It spread from the hills and was heard of as being there long before it reached the valley.

(*b*) It did not appear in villages in the plains as a rule, unless there was a history of its being introduced.

(*c*) There was no intermittent fever in the hill villages at the time and very little in the plains.

(*d*) It was a very healthy cold weather till typhus appeared in the spring.

(*e*) The fever ran a very decided course.

(*f*) The symptoms are those of typhus and not malarial fever.

(*g*) When the disease entered a family scarcely any of its members ever escaped.

Though typhus cannot, in my opinion, originate from malarial fever, there is no doubt but that given a people suffering much from malarial fever on the verge of a country where typhus is endemic, the disease will sooner or later be introduced, and, finding suitable soil, will spread with marvellous rapidity. In bad cases of malarial fever, more especially those in which the protozoa have brought about condition in body which produce irregularly remittent and continued fever, a suitable soil is prepared for the ravages of the typhus germ. The blood in such cases is starved of its oxygen, and all the tissues in consequence insufficiently nourished. Should typhus not be at hand, a malarial fever will remain simply that all through, as in Africa and Lower India. Even in places like Peshawar this has been well seen.

In the winter of 1892-93, after an abnormal rainfall, the worst outbreak of malarial fever of an irregularly remittent or continued form, known for many years, occurred principally amongst the European soldiers. They did not get typhus—there was none in the valley—but later on the prisoners in the jail suffered from a disease of a similar kind with identical *post-mortem* appearances. But then typhus appeared in the valley and cases of the disease soon occurred amongst new admissions to the jail, and from then all cases admitted to the hospital were of undoubted typhus.

Some will object that once you have a continued or irregularly remittent form of fever, you lose the very essential of a malarial fever, *viz.*, its periodic character.

But I contend that when a patient suffering from ordinary periodic fever passes on to the more serious remittent, irregular remittent or continued type, it is as well before assuming he has one of the recognised continued fever, such as typhus or enteric, to exclude conditions that are so likely to follow the disintegration of blood, and necessarily the collection in the body of what might be described as extraneous material.

These conditions include congestions of organs and effusions in all parts of the body, hæmorrhagic and serous, and the character of the fever will depend upon those most affected.

Where, as in the Peshawar cases, you get hæmorrhages into the duodenum and large intestine, vomiting and purging result, or where there is effusion on to the surface of the brain, delirium and head symptoms develop, or again great congestion of the liver, the fever becomes of an increasingly continued type.

Some will give a definite name to a disease from a glance at a temperature chart, but after all the temperature is only one symptom, and before coming to any decision, the wise man will weigh all his evidence together.

Following this rule in the case of the two diseases in question, it seems very unlikely that typhus can arise from remittent fevers *de novo*, and when it appears to do so either the local conditions are such as to be amply sufficient to produce an epidemic of a disease apparently contagious, or the typhus germ has been introduced from quarters where it is endemic.

Where malarial fever has been free from the suspicion of being associated with typhus and yet seemed to assume a contagious form, it is generally found to follow flooding and water-logging of the country with rapid drying supervening. And it is not unlikely that in contaminated soils, especially on the sites of old cities, or where much organic matter is entangled in a clayey-alluvium, micro-organisms other than those of the protozoa of malaria find easy entrance to the body in company with those of malaria proper.

Precautionary measures.—Little it is to be feared can be hoped for towards preventing the disease by changing the habits of the people as to overcrowding in badly-constructed houses. Much can, however, be done if early intimation of the presence of the disease is given and medical aid is at once provided. In some places, as in Kulu, the people have learnt by bitter experience that the disease is contagious; but, in others, advice given as to this point alone would prevent much of the spread.

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*The population of Upper Kulu is 50,551. This, calculated at a yearly rate, equals a mortality of 49 per 1,000!

It is very necessary that steps should be speedily taken to minimise, as far as possible, the ravages of this disease, as the scanty hill populations can ill-afford to lose bread-winners. Besides which, the disease may at any time spread to our hill stations, and though not a disease of the well-to-do, still many a judge has been seized on his bench, and a similar fate may befall those who visit the hills yearly for the sake of their health. Suraj or Plach, the part of Kulu I have already referred to as suffering so intensely this year, is only about 50 miles from Simla.

CEREBRO-SPINAL FEVER.

BY JAS. MOORHEAD, M.A., M.D.,
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I HAVE ventured to select cerebro-spinal fever as the subject of this paper, because, in the first place, the disease so named has only been recently seen or reported in India, and because, in the second place, the disease as seen here differs, so far as my experience goes, in some very important features, from that as observed in other countries.

This specific and deadly fever has been known under various names: it has been described as "spotted fever" in America and as cerebral-typhus in Germany; it has been described also under the names of epidemic meningitis and epidemic cerebro-spinal meningitis; it has been popularly known as "the black sickness" in Dublin and as "nackenstarre" or stiff-neck in Germany. The name I have adopted is that which has been given by the London College of Physicians.

The history of this disease in Europe goes back for certain, for nearly one hundred years, and there is some reason to believe, Aitken tells us, that it goes back even as far as the 14th century. The first well ascertained epidemic occurred at Genoa in 1805, and in the following year it appeared in the United States, and continued to prevail there for ten years. During the same time, and off and on during the past half century, it was observed in France, in Italy, in Spain, and in Denmark. In 1854, and for seven years afterwards, it raged in Sweden, where it is said to have destroyed more than 4,000 persons. In 1860 to 1870 it showed itself again in America, in 1863 it broke out in the Northern Provinces of Prussia, and from that time it has hardly ever ceased to shew itself in some part of the German Empire. The British Islands have hitherto enjoyed a remarkable immunity. Scotland, it is said, has never been attacked, only a few isolated epidemics have occurred in England, and though the disease has twice appeared in Ireland, once in the famine year of 1846, and again in 1867, it was seen chiefly among the inmates of a few work-houses and among the recruits of the Royal Irish Constabulary stationed in Dublin.

Here, in India, the disease has been practically unknown, until within the last fourteen years. Chevers, in his work "Diseases of India," tells us he only met with one doubtful case, which recovered, and that neither Ewart, nor Goodeve, nor Duka ever saw a single case, though the two latter had watched sedulously for this disease. Cerebro-spinal fever appears for the first time in 1881 in the returns compiled by the Sanitary Commissioner with the Government of India. Since then, up to 1892, 333 cases with 259 deaths have been shewn, as having occurred in the army and in jails. The Sanitary Report for 1893 has not yet been printed, but Surgeon-Major Lewtas, Statistical Officer, has kindly informed me, there were in all fifteen cases with ten deaths. The figures I have just given do not represent, I believe, the actual prevalence of the disease, as cases and deaths, under the head of inflammation of the cerebral membranes, figure largely in the returns, during the past ten years, and I have little doubt many of the cases and deaths thus shewn would more correctly have appeared under the name of the disease I have chosen for this paper. I see, for instance, in 1886, inflammation of the cerebral membranes is reported to have caused eighteen admissions with fifteen deaths in jail, and eighteen admissions with twelve deaths in the army, European and Native; and, again, in 1887, under the same heading, appears seventeen admissions with thirteen deaths in jails and twelve admissions with seven deaths in the army.

Cerebro-spinal fever in a sporadic form has been very widely distributed throughout India, none of the three Presidencies having completely escaped. The disease has also appeared in Burma and in the Andamans and Nicobars. The outbreaks, however, have been practically confined to Bengal and Bombay, only one case having been reported from Coimbatore, in Madras. Jails have suffered chiefly, only three cases with one death having been reported in the European, and twenty-one cases with fourteen deaths in the Native army, during the last thirteen years. The Bengal Jails have suffered most, one-fifth of the total jails in the province having been attacked. The Alipore Central Jail has returned several cases and deaths every year since 1886. Of the Bombay Jail, Shikarpur has been chiefly attacked; and among the jails of the Punjab, the disease has been seen chiefly in the Central District Jail at Lahore.

How far, if at all, the civil population are affected, we have no data to judge from. The disease has no place in the returns of civil hospitals and dispensaries.

My first practical acquaintance with cerebro-spinal fever dates from 1889, when I was in charge of the Hazaribagh Jail. In that year there were two outbreaks in the jail, the first occurring in May and June (first case 16th May, last 5th June), the second in October and November (first case 8th October, last 8th November).

In each outbreak there were seven cases, six deaths occurring in the first and five in the second. I met with the disease again in 1891 and 1892, while in medical charge of the Bhagulpur Central Jail. There, however, I had only two cases, one of which recovered. I have had in all sixteen cases with twelve deaths.

I shall now try to give you the results of my observations, and shall also endeavour to contrast the disease as seen by me and described in books. I have had no opportunity of reading the reports of other Indian medical officers, except the very brief extracts that have appeared in Administrative Reports, and so am unable to say how far their experience coincides with or differs from mine.

First, as to clinical history. The disease, as a rule, sets in suddenly with symptoms like those seen in severe malarious fever, the temperature quickly rising to about 103° F., though it may run up to 105° F., as it did in one case. The course of the *fever* is *very irregular*, sometimes the morning temperature being the same as the evening; sometimes one or two degrees less; and occasionally higher. When it is prolonged over several days the temperature falls and becomes more or less remittent, the range being from about 99° F. to 102° F. A special rise towards the last, such as is mentioned by Fagge and Pye Smith, occurred in none of my cases.

Nervous disturbances always occur early, and soon become prominent. Pain, which may be most excruciating, is early felt, sometimes all over the body, sometimes only in the joints, but as a general rule in the head. In a small proportion of the cases, pain in the neck and back was a prominent symptom.

Delirium, accompanied in some cases by great restlessness, but not of a violent type, occurred in half or more of my cases. It began in one case in ten hours; in a second, in twelve hours; in two cases, after twenty-four hours; in a fifth case, after forty-eight hours; in a sixth, after sixty hours; in a seventh, after eighty-four hours; and in an eighth, not till the fifth day.

Coma was present in ten of the fatal cases; it was present also in one case that recovered, lasting for about sixty-two hours. This condition may supervene at a very early period; in one case it set in within three hours from the commencement of the fever. As a rule, it was preceded by delirium, and where such was the case it followed in from about twelve to forty hours from the commencement of the latter. The comatose condition persisted in almost all cases till death. Consciousness was partially regained after eight days: in one case that survived twenty-one days, and completely after five or six days; in a second case that lived thirty-one days. In the latter case, though consciousness began to return after three days, the patient was unable to speak for another six days; then for five days he continued able to speak, but again became comatose and remained in that condition for sixty hours; again consciousness returned, to be followed again after thirty-six hours by coma. Alternations of these conditions occurred almost daily for five days up to the patient's death on the 31st day of the disease. The coma in all cases, except one, was unaccompanied by stertor; deep groaning was present in one case.

Retraction of the head occurred in only three cases, and was present in one of the patients that recovered. This symptom appears to have been more frequently met with in other countries. Flint tells us it has been observed in eighteen out of sixty cases, and English authorities describe it as still more frequent. Opisthotonos was present in no case, neither was trismus; this latter, according to Flint, has been observed in 17 out of 60 cases. Rigidity of the rectus abdominis in a marked degree was present in one case that recovered.

Convulsions (clonic) occurred in one case that survived 31 days shortly before death, the contractions sometimes occurring in the upper extremities, sometimes in lower, and sometimes only in particular muscles.

Vomiting, which is mentioned in books as an early and very common symptom, was absent in all my cases, except two, and in these it occurred only shortly before death; pain in the stomach was very rarely specially complained of. Uneasiness, however, with or without puffiness, was an early symptom in five cases; constipation was present in some cases, while in two cases the bowels were relaxed.

Pericarditis, with effusion, was present in ten of the twelve fatal cases; it was present in two cases that survived only ten and twelve hours after the commencement of the attack. This complication is not mentioned either by Aitken, by Roberts, by Quain, or by Eustace Smith. Flint, of New York, mentions it, and so do Fagge and Pye Smith, but the latter say it is dependent upon secondary pyæmia. This view, however correct it may be, generally, is not applicable to the two very early fatal cases I have just mentioned.

Lung complications were present in five of the fatal cases and in one that survived in two of the cases there was pleuro-pneumonia, and in other three congestion or red or grey hepatization in one or both lungs. In one case that survived there was congestion of the right lung about the seventeenth day of the disease. It is worthy of notice that in no case was there the characteristic sputum of pneumonia, and that cough was not present except in one case. The respirations, however, in one case, were as many as fifty-two per minute.

Hearing was much impaired in one of the surviving cases, in which consciousness was never lost; in the same case, *articulation* was very *difficult*, and there was considerable impairment of the mental faculties for months after convalescence began. Difficulty in articulation was also noticed in one case that proved fatal.

Retention of urine were present in two cases.

Eruptions, which appear to have been common in other countries, were noticed in none of my cases; the same remark applies to eye complications.

Next, as to morbid anatomy. Morbid changes were present in the membranes of the brain and spinal cord, in the lungs and pericardium. In the first mentioned, the appearances varied a good deal: the one case that survived twenty days, the vessels of the pia mater were markedly shrivelled; and in a second case, that lived thirty-one days, contraction of the same vessels was noticed. The examination in the former case was made within two hours, and in the latter within one hour after death. In six or seven of the cases there was intense congestion of the membranes, the veins at least in one case being filled with partially coagulated blood.

In the two cases that survived over twenty days, the sinuses at the base of the brain were practically empty; in all the other cases examined, some of the petrosal sinuses contained partially or completely decolorized coagula. A fibrinous clot, 8 inches long, was in one case drawn out of the right interior petrosal sinus. An exudation, varying in character and extent, was present in all the cases examined, except two : in one case, that died after twelve hours, it was clear and gum-like; in another, that lived twenty-one days, it was slatey in colour; while in all the others, it was distinctly yellow; in a few cases being purulent or semi-purulent. The extent of the exudation varied much : in the case that survived thirty-one days, there was only a trace of lymph over the pons varolii, and inferior perforated spot also between the posterior surface of the medulla oblongata and the cerebellum. There were, however, several points of purulent infiltration on the convex portion of the right hemisphere, close to the longitudinal fissure, one similar point on left hemisphere, and about fifteen drops of actual pus in each posterior cornu of the lateral ventricles ; in another case, that lived only ten hours, the exudation was present in two or three of the sulci of the convex portion of the right hemisphere, and in one or two of the left in a similar position. In these situations it was very distinct and of a yellow colour. As a rule the exudation was present along the base of the brain, continuously from the medulla oblongata to the optic commissure ; in one case it reached to a point anterior to it ; and in a second it surrounded the pituitary body; it was present also in several of the sulci of the convex portion of the brain and sometimes over the floor of the fourth ventricle and between the holes of the cerebellum. The brain itself only presented numerous points on section ; in one case there was no sign of softening. It is probable, however, the superficial layers of the cortex are to some extent affected in the diseased process.

The membranes of the spinal cord also varied a good deal in appearance : in the case that lived thirty-one days there was neither congestion nor exudation ; in three cases there was congestion only ; while in six or seven cases the cord was partially or completely surrounded by a more or less distinct layer of lymph exudation. The exudation in all cases was yellow, except one, in which it was clear and gumlike, that formed in the membranes of the brain. In one case the exudation was continued over the cauda equina. In one case about 2oz. of puriform fluid escaped, on section of the membranes in the cervical region, and similar fluid was formed in the lumbar region of the same case ; in another case there was a quantity of actual pus in the lumbar region. The spinal cord itself was not noticed as softened.

The condition of the lungs varied also in the two cases that survived over twenty days, both were intensely anæmic, in fact almost bloodless ; in five cases no unusual appearances were noticed, while in the remaining five fatal cases, very distinct morbid changes were present. In one, that of a man who died in four days, the whole of the right lung was hepatized' the upper lobe being in a state of grey hepatization and the whole of the left lung was greatly congested, though no part was solidified. In a second case, both lungs were congested, the right being adherent to the chest wall by recent lymph, a small portion of the lower lobe of the same lung being in a state of red hepatization. In a third case, the left lung was adherent to the chest wall almost throughout by a very thick layer of recent yellow lymph, a portion of the lower lobe of the same lung being in a state of red hepatization, the right lung was congested and the right pleural cavity contained about 5oz. of serous fluid ; in a fourth case, part of the right lung and the whole of the left was congested, and portion of the latter hepatized. In the fifth case, the left lung only was congested.

The pericardium in ten out of the twelve fatal cases contained more or less serous fluid, with or without congestion of its lining membrane. There was, on an average, a little over 2oz. ; even in the two cases that survived ten and twelve hours, quite 2oz. or more were present.

Both ventricles of the heart contained, in one case large fibrinous clots, and in another non-fibrinous clots were present. In addition to the morbid changes already described, I may add that the liver was noted as enlarged in four cases, its weight in one case being 3lbs. and in another 3lbs. 12oz. The spleen were also enlarged in four cases, but the condition existed in one if not two of the prisoners before being attacked.

The diagnosis of cerebro-spinal fever, at the commencement of an outbreak, is sometimes by no means easy. Layden tells as that an outbreak of typhoid fever among the German troops, before Paris, in 1870, was at first mistaken for cerebro-spinal fever, owing to the presence, in a series of cases, of marked rigidity of the neck, severe headache, hyperæsthesia, low temperature and constipation ; but that the autopsies demonstrated the real nature of the disease. Here, in India, the only disease for which it is likely to be mistaken is a severe malarious remittent ; and, I think, it must be admitted that a positive diagnosis from that disease is hardly possible, till a *post-mortem* examination has been made. The excruciating headache and backache, the irregularity of the temperature, the early setting in of delirium followed by coma, and the rapidly fatal character of the disease are the points that may be most relied upon.

The prognosis in India is very unfavourable ; there were 15 deaths out of 17 cases in jails in 1892 and 29 deaths out of 35 cases in 1891 ; in the latter year, there were eleven cases in the Alipore Central Jail, all of which proved fatal. The mortality in my cases was somewhat less, being only 75 per cent. In Europe the general prognosis is less unfavourable, the mean mortality being only about 40 per cent., though in some epidemics, as many as four-fifths of those attacked have died. The range of temperature assists a little in forming a prognosis ; in my most rapidly fatal case 102·8° F. was the highest temperature recorded.

The early setting in of coma is an unfavourable symptom, but one of my cases that recovered remained unconscious for over 60 hours. Convalescence may be very protracted: one of my cases remained in hospital for six and a half months; in that case there was less of hearing with headache for weeks, and the mental faculties remained impaired for months.

The pathology of the disease appears to be fairly well established, if we accept the authority of Sternberg, Netter, Weichselbaum, and others, according to whom has been demonstrated the presence of diplococcus pneumonia, and others micro-organisms in the meningeal exudation, and he assumes, therefore, there is little doubt that the meningeal inflammation is due to the presence of those organisms.

The etiology of the disease is still a mystery. That a specific poison exists, the prevalence of the disease as an epidemic implies; but as to the nature and source of the poison, as to the condition under which it is generated and diffused, we have as yet no positive knowledge. The disease has its favorite habitat in prisons and barracks; it appears to attack males more than females; it attacks persons in all conditions and at all periods of life, though its favorite victims appear to be robust males, between the ages of fifteen and thirty; it prevails generally in the cold season; it does not appear to be either infectious or contagious, or to be much influenced by general sanitary conditions. The outbreaks in the Alipore Central Jail were ascribed by the committee which investigated the disease in 1886 to overcrowding and defective ventilation, but though the recommendations of the commitee were carried out, outbreaks of the disease have occurred every year since, and there has been an increase rather than a decrease in mortality from that cause. The sanitary condition of the Hazaribagh Jail, in which my first cases occurred, differed so far, as I know, in no respect before, during, or in the interval between the outbreaks. There was not even an approach to overcrowding, the capacity of the four wards, in which cases occurred, being few in excess of the numbers actually locked up. The site of the jail is good, being on a plateau, 2,000 feet above sea level, and there are no defects in ventilation. The general health had been remarkably good from the beginning of the year up to the end of April, and we had no death for over seven months out of a daily average population of 188.

Treatment is most unsatisfactory, and that this is so is, I think, not surprising when the nature and extent of the disease are considered. Treatment must be mainly symptomatic, and various drugs have been tried—opium, quinine, bromide, iodides, belladonna, chloral hydrate, mercury and others—but with very scanty success. Blood-letting was largely practised in former days, and is again being resorted to in Germany. Zienissen and others strongly recommend the use of ice bags to the head, neck and back for weeks together, if necessary, and extensive vesication of the head, neck and back has been tried. My patients, as a rule, were treated in a darkened ward, separate from others, most of the medicines abovementioned were given, and others besides. The diet consisted of milk, sago and soup, generally given by the mouth, and in a few cases by the rectum. The clothing of the sick was constantly changed, personal cleanliness attended to, and thorough disinfection of the wards carried out.

ADDENDUM.

When I wrote the paper I despatched some days ago I had not the report of my Bhagalpur cases before me. There was great delay in sending me those reports, and I wrote the paper without them. The reports have reached me to-day, and I think some of the features of the two cases were so peculiar that I should bring them to the notice of this Congress.

The case that recovered presented the following peculiar features:—

1. There were marked contractions of the left arm and leg and to some extent of the left rectus abdominis on the second day of the disease. The contractions gradually disappeared, that of the leg before that of the arm.

2. The temperature on the second day fell to 95·5°F. in the rectum and 95·4°F. in axilla; temperature taken very carefully by myself, as I doubted the accuracy of that taken by Hospital Assistant.

3. Pulse on second day fell to 40.

4. Respiration on second day fell to 12 per minute.

5. Suppression of urine almost complete for 36 hours.

The patient remained in hospital from 26th December 1891 to 27th January 1892.

The patient that died was admitted to hospital about noon on the 6th November 1892, with the high fever. I saw him at the time of admission. He made no complaint specially of pains anywhere. Soon after admission he vomited two or three times, and became unconscious about 4 P.M.; same day about 7-30 P.M. both hands and arms became contracted, and he was unable to swallow and continued unconscious. The next morning (7th) I found paralysis of motion complete and of sensation nearly so of right leg; left leg normal, dilation to some extent of both pupils, which, however, were sensitive to light, lockjaw, contraction of both forearms on arms, fingers normal. The patient could be roused somewhat to consciousness, and he was able to swallow and sometimes to open his mouth just a little. With his left hand he continued, as a rule, to grasp his penis, and when the hand was taken away it returned to the penis. The temperature in his right hock was 97·6°F., left hock 98·3°F., axilla 99·6°F. (temperature taken by myself), pulse 104, respiration 20 At 3-30 P.M. same day temperature rose to 103·2°. Next morning (8th) temperature down again to 99·6°, contraction of elbow joint diminished, sensation returned to right leg, and there was only partial paralysis of motion, hearing fair, jaws still fixed, but patient could swallow; pulse 100, respirations 20.

Temperature at 4 P.M. 101·8°. Condition otherwise improved; patient able to speak and to drink easily; contraction of elbow joints gone.

9th December.—Morning temperature 102·4°, pulse 112, complaint of pain over heart, but no signs of pericarditis, right leg still partially paralysed, tongue very much furred.

From 10th to 21st December, when patient died on 16th day of the disease, temperature irregular, ranging from 98·8°F. to 103·2°F.

On 12th December he had difficulty in articulation; pupils noted as normal on that date.

On 13th December he had severe abdominal pain.

On 19th December vomiting of black blood and mucus hiccough in the evening; gone next morning to return again in the evening.

There was no retraction of the head and no opisthotonos and no eruption; much complaint at one time of pain in spine between the scapulæ.

Post-mortem examination showed following marked appearances:—

A layer of yellow lymph along base of brain from medulla oblongata to a point a little in front of optic commissure.

A line of lymph along the anterior and inferior borders of lateral lobes of cerebellum.

A layer of lymph on posterior aspect of cerebellum close to fissure.

A point of purulent infiltration $\frac{5}{8}$ inch long $\frac{3}{8}$ inch broad filling up sulcus on frontal lobe close to longitudinal fissure and two inches behind anterior border. Distension of both lateral ventricles, of one especially with somewhat purulent fluid. Cerebro-spinal fluid in excess.

Brain itself apparently healthy; spinal cord in upper cervical region completely surrounded by a layer of yellow lymph; posterior aspect of cord right down to corda-equina covered with lymph; considerable quantity of serous fluid in lumbar region.

No pericardial effusion, no disease of lungs.

DISCUSSION.

B. C. Sen (Calcutta) said Dr. D. N. Mitra and he had made a few *post-mortem* examinations at the Campbell Hospital, and had observed deposition of lymph at the base of the brain and upper part of the spinal cord when death took place in the early stage of the disease, but if the patient survived, say, two weeks or more, purulent deposits were not infrequently detected. From the morbid appearances the disease might, with greater propriety, be called cerebro-spinal meningitis. It had so many distinctive features of its own that it was not very difficult to differentiate it from fevers of other kinds.

K. C. Bose (Calcutta) said he had never seen cerebro-spinal fever breaking out in an epidemic form in Calcutta. Isolated cases only were seen in that part of the country. Cerebro-spinal fever was most commonly ushered in with severe frontal headache and high pyrexia, with slight retraction of the neck, sickness or vomiting. The temperature ran high, in some cases as high as 105°. On the third day the articulation of the patient was affected, his vision became dim, and in some cases strabismus of one or both eyes was noticed. The bowels, as a rule, were constipated. The symptoms of meningitis in some cases appeared early, whilst in others they were deferred until the end of the first week. The cause of the disease was not atmospheric influence, but a specific micro-organism, which much resembled the bacillus of pneumonia. He was sorry he had not been able to isolate the micro-organism, but he had been told by his kind friend, Dr. Crombie, that he had been able to see it. He congratulated Dr. Chambers on his being able to see several epidemics of cerebro-spinal fever in Calcutta, but could not accept his statement, unless he brought forward the results of his observations.

Carleton (Sabathu) said typhus fever was very prevalent every year in the Sevraj of the Kulu Sub-division of the Kangra District of the Punjab, especially so this year, when it had been epidemic throughout the whole of that region. Parts of the Native States of Nundi and Sukil, bordering on the Kulu Sevraj, were equally affected. In Kulu Sevraj alone this year the number of deaths had been over 600. Typhus fever, as he had seen it in Kulu, was only found above an elevation of 5,000 or 6,000 feet up to 12,000 feet; in fact the majority of the cases were at an elevation of 8,000 or 9,000 feet. A typical case, as seen in Kulu, began with several days of malaise, then fever began at once with high temperature, rising to 106° or 107° on the third or fourth day, with a slight morning fall and evening rise, but never more than about half a degree. On the seventh or fourteenth day there might be a sudden fall, sometimes of 2° or 3°, usually at night or in the early morning, with a corresponding rise in the evening, though usually in favourable cases; in the second week the temperature was not so high as in the first week, and in such cases, in the beginning of the third week, the temperature became normal falling suddenly 3° or 4°. This was very characteristic in every case of the disease he had noticed. Sometimes before death the temperature rose very high. Death occurred usually during the second week, and recovery usually about the twelfth or fourteenth day, sometimes not until the twenty-first day, and in some rare cases the fever might go on for a month. Thirst was very great and constant. Bowels fairly regular, rarely any diarrhœa. The prostration from the onset was very great, the patient lying on his back, usually in a half-unconscious state, taking no notice of any one, or anything, and roused with difficulty. Often there was delirium, lasting for hours at a time, usually at night.

The eruption—a characteristic symptom of typhus—began on the fourth or fifth day, usually on the wrists, axillæ, or abdomen, and often extended over the whole body, sometimes on the legs and arms. It continued to appear for two or three days, and remained until during the third week, when it gradually disappeared, except in fatal cases when it remained until after death. The rash had two appearances, one a mottling and the other spots, slightly elevated, the former looking as if it were deeper in the tissues. There was always the mottled appearance, but in some cases there might not be any spot. The spots remained to the end, though changing to a darker colour. At first the spots were effaced by pressure, disappearing for a few minutes. Later they were not so effaced. In children the rash might be mistaken for measles, especially if on the face. Recovery was very rapid and relapses very uncommon, only rarely any permanent injury remaining. The mortality was high in adults and low in children.

THE POSSIBLE ANTAGONISM BETWEEN MALARIA AND PHTHISIS.

BY ARDESHIR DOSSABHOY COOPER.

MY object in bringing this subject to the notice is to give rise to a discussion on this very important point, and to have, if possible, a definite pronouncement of its views about it. The discussion and the elucidation of the question are malaria and phthisis antagonistic? Are both of scientific and practical importance for obvious reasons? My contribution to it is merely mechanical in recording and laying before you the opinions of others. I have nothing, either from personal experience or scientific investigation, to add to your deliberations where I have come more to learn than to teach, being better prepared to hear than to speak. There is much need for the above question to be answered and for attempts to be made to investigate and determine the relationship existing between the two. The matter has received at our hands less attention than its importance deserves, and the determining of the fact, if it be a fact, cannot fail to be of practical value. The subject is full of difficulties, and numerous factors of climate, food and racial peculiarities, &c., have to be taken into consideration before a solution can be arrived at, for which purpose no sufficient data are available. However, I trust, an attempt may here be made which will, in the fulness of time, bear some fruit.

As late as 1811 it was put forth by Wells that malaria and phthisis were opposed to each other, and he cited many authorities in support of his views. In 1841 Harrison of Horncastle remarked on and drew the attention of the profession to the infrequency of consumption in the fens. These views were revived by M. Bedouine in 1856, who held that malaria and phthisis were opposed to each other. He formulated his views under three heads : " (*a*) that where malarial endemic fevers are prevalent phthisis is rare, and that the frequency of one class of cases is inversely proportionate to that of the other ; (*b*) that where malaria decreases phthisis increases ; and (*c*) that phthisis is more curable in malarious regions than in others. " Writing on this subject the late Dr. Peacock instances six cases, in which phthisical patients under his treatment were found suffering from ague, thus leading him to reject the idea of there being any material antagonism between the two maladies, but he is careful to add that " the facts do not, however, warrant the denial of the supposition altogether, and there are probably few popular ideas which have not some foundation in truth."

Dr. Peter Gowan, formerly in the service of the King of Siam, does not believe in the supposed antagonism, as he has observed ague and phthisis prevailing in the country. He also is careful to admit that " it was unquestionably shown to be almost, if not quite, absent from many such localities and to be less prevalent where the fever was of a bad or obstinate kind."

Phthisis is hardly ever seen in Corea, although malarial fevers, which go by the name of " Hakuchu," are common enough.

It has been observed by the great Professor Virchow that fever prevailed to a frightful extent in Silesia where nearly every one had enlarged spleen (although the medico-legal importance of the fact does not seem to have been sufficiently realised by the inhabitants). Professor Virchow hardly ever saw a case of phthisis, and he was borne out in this observation by all the medical practitioners in the country. Dr. Hunter, late Colonial Surgeon to British Honduras, says that "phthisis does not seem to originate in any degree in the Colony, but very frequently cases of this disease are sent to our public hospital from some neighbouring state. Some instances of this affection seem to derive the greatest benefit from a stay in the Colony—all the more violent symptoms subside, strength is regained and a life, that in other countries would have been of short duration, has been prolonged, and a good old age arrived at." The capital town of the Colony is surrounded by swamps and thick jungle where fevers are frequent, although not of very severe type. In 1890, sixty-nine cases of intermittent fever with no deaths, and nine cases of remittent fever with two deaths, were treated in the hospital. This by no means represents the number of cases occurring. They must have been very numerous but not sufficiently serious for hospital treatment.

Numerous American observers, as Dr. Green and others, advance views supporting the antagonism. Dr. Green has remarked that not a single case of phthisis was to be seen in his district where paludal fevers were very common, and he observes that phthisical patients coming to the locality were much benefited and found " relief as decided as it was permanent." He mentions an instance in which a morass near Rutland was converted into a pool when fevers were replaced by phthisis, and on the reconversion of the pool into morass intermittent fevers reappeared.

A French author, M. Jurdanet, in a book published in 1861, mentions two provinces, Yucatan and Tabasco. In Tabasco fevers are very common and phthisis rare, whereas in Yucatan it is the other way about, and the fact is so well known and appreciated that persons suffering from phthisis are ordered to Tabasco by medical advisers.

I will now take you over the experiences of Dr. R. W. Felkin, Lecturer on the Diseases of the Tropics in the Edinburgh School of Medicine, in his travels through Central Africa, where he had exceptional and varied opportunities of observing the prevalence of malaria and phthisis. He seems to have come across very few cases of phthisis, and even these corresponded in a very remarkable manner with the absence of malaria. In the swampy districts of Unyoro and Uganda he met with but few cases of phthisis. The same is his experience in his journey from Khartoum to the Albert Lake along the Valley of the Nile. However, while returning, he saw a large number of cases in the district of Shuli at an altitude of 3,000 to 4,000 feet, where malaria is rare. Of imported phthisis he met numerous cases in the Ghazal district, where they had come from the elevated regions of Mombutu. Again, in the highlands of Gebel-marah region phthisis was observed to prevail extensively and the ague was quite unknown. Dr. Felkin mentions several cases of consumption benefited and even completely cured by a sojourn in malarious districts, although he is careful enough to take into account the element of coincidence or accident in the matter.

It will be not uninteresting to notice to a certain extent the geographical distribution of these diseases. In Siam phthisis and malaria are both common. In Corea, as already mentioned, ague is common ; though the country is dry, with very few marshes and swamps, phthisis is quite unknown. In Japan, ague is rare and phthisis not very frequent. Southern provinces of China are very malarious, but it is not known whether phthisis is rare or otherwise. Paludal fevers are very rife in Burmah, and I hope some light will be thrown by medical men from the provinces as to the prevalence of phthisis. Phthisis is very infrequent in Senegal, Benguela, Angola and East Indies, malaria being common. Australia, Tasmania and New Zealand are free from paludal affection, but yield a very heavy death-rate from phthisis. Phthisis is very frequent in Nubia, Chilli and Lama, and almost unknown in Egypt, Syria, Algiers and the steppes of the Kirghiz. From these facts we cannot help feeling that neither temperature, atmospheric moisture, nor geographical position explain this. Dr. Felkin wrote to Dr. Haviland, distinguished for his researches into the geographical distribution of disease in England, for information respecting this subject, and I will venture to transcribe an abstract from his letter to Dr. Felkin. He writes: "Lincolnshire has a low mortality from phthisis among females, and forms an exception to the general rule which at present seems hidden in obscurity. We must, however, remember that ague is prevalent in this part of England, and it is said that this disease is seldom associated with consumption. A more important coincident fact is the one that a greater portion of this land is reclaimed from the sea. It is well-known that many sites, although damp with sea water, enjoy a remarkably low mortality from phthisis. Again, if you look along the once ague-districts, the North Coast of Kent, you will see the whole length of it characterised by low mortality from phthisis among females, although much exposed to strong winds. So far then as I can see from the few instances quoted, there appears to be no marked increase of phthisis in the districts named as once characterised by ague, but it does appear that in such localities phthisis is less prevalent than in other districts, although these may be exposed to the full force of the strong winds found to be so fatal to the consumptive elsewhere. This involves the question: Are there as many consumptives to kill in these malarious localities, and if there are not, why not?"

Racial peculiarities for these diseases would no doubt be very interesting, and could not fail to throw considerable light for the solution of this matter had we reliable and numerous data to work upon. Unfortunately we do not stand at present in a position to speak with any degree of authority or weight on the point. Besides, the racial question is so very intimately mixed up with the climatic, food and social considerations, that it seems at present well nigh impossible to separate one from the other in order to determine with accuracy the part played by each. I will, however, venture to put before you the following fragments of information collected from certain portions of the United States which are now the mixing ground of various races, and where practically identical circumstances of food and climate prevail. Coloured races are more liable to tuberculosis and pneumonia and less liable to malaria and yellow-fever than the white. Jews are said to have the highest vitality and the least mortality, being remarkably free from phthisis. The Irish race is peculiarly prone to tubercle of the lungs. Aboriginal Indians are being decimated by phthisis which was quite unknown amongst them. These bits of vital statistics are given for what they are worth. They do not throw much light on the subject, and are given here to direct your attention to the discussion of the question of racial peculiarity.

You must have noticed, gentlemen, that no mention whatever has been made of India throughout this paper where both the diseases are found existing. I will leave it to you to give benefit of your experience one to another from different parts of this great continent, and to determine whether malarious parts of it are absolutely or comparatively free from phthisis, and whether the malarious localities are more favourable residences for phthisical patients. The determining of these questions is beset with many difficulties, not the least important of which is imported cases of phthisis in a district which is so easy and common in these days of easy and rapid travelling. If I can venture to suggest, I should ask you for various reasons to ignore altogether the data gathered from the metropolitan cities and large towns where population is more or less fluctuating and rely mainly on statistics gathered from rural districts where population is more stationary.

ON THE PROPHYLAXIS OF MALARIAL FEVERS.

BY A. DUNCAN, M.D., B.S., F.R.C.S.,
Surgeon-Major, I. M. S.

I PROPOSE, with regard to the prophylaxis of malarial fevers, to offer: first, a short resumé of the opinions of medical officers of our own and other countries; and, secondly, to narrate the results of my own experience. I do not intend to enter into the points of prevention, such as are involved in the disposal of men's bodies at night at a distance above the ground, in their dress, etc., but to restrict myself to the question of preventative drugs and other ingesta. The evidence, as we shall see, is somewhat contradictory as regards any efficacy derived therefrom.

Amongst the French physicians, M. Corré holds it still unproved that that method of keeping the organism impregnated with drugs intended to kill the malarial organism directly it gets into the body, or to modify the latter, so as to render it insensible to its action, is established. He, however, considers that such a course is feasible under the daily exhibition of tea, or small doses of quinine given at the beginning of the malarious season, or whenever troops are operating in a malarious country. At any rate, such means will diminish the chance of infection. They will not, however, be of any avail against the more pernicious forms of fever.

M. Marvaud recommends tea, coffee and small doses of alcohol, and states that a daily ration of quinine during the Niger expedition gave good results, except as regards the gravest forms of malarial fever.

MM. Kelsch and Kiener state that the officers of the French marine favour the exhibition of quinine. But their experience as regards the severe forms met with in the Niger expedition agree with those narrated by M. Marvaud. They, however, on the whole, prefer the exhibition of coffee, tea, or small doses of alcohol. That the latter gave better results than quinine, and moreover did not habituate the organism to the effects of this remedy, and thus render it insensible to its action when required to combat the actual onset of malarial fevers.

M. Thorel found successful results in Mekong.

M. Bizardel even found it admirable in warding off attacks of pernicious ague.

The Austrian and Russian Surgeons, however, found no advantage to arise from the prophylactic use of quinine on the Danube or the Caucasus.

M. Pola found that quinine was given with good results to the soldiers posted in bad malarial spots; 736 soldiers were lodged in the same barrack, 500 of whom took quinine, with attacks of malarial fever in the proportion of 18 per cent., whilst the remainder, who had not taken it, were attacked in the proportion of 28 per cent.

Coming now to the Italian physicians, notable results have been obtained by Tommasi Crudeli. This physician experimented with other drugs than quinine. In 1880 he began to try the effect of arsenic with encouraging results. Dr. Ricchi in 1883 gave it to 78 persons in the district of Borino, where malaria is very rife; of the 39 who took it, 36 escaped entirely, while the three remaining had only slight attacks; of the 39 who did not take it, the great majority had severe attacks of fever. Again, in 1885, 657 persons were experimented upon. Of these 402 gave good results, 119 pretty good, whilst the effect was indifferent in 136.

Dr. Crudeli also speaks highly of a decoction of lemon. Such therefore have been the results obtained by our continental brethren.

With regard to *America* we have the experience derived from the War of the Succession. Surgeon Bryan found quinine and cinchona to be sure prophylactics, but in all cases the experience of this war did not show that the indiscriminate use of quinine as a prophylactic was necessary. When men were exposed in a specially dangerous locality it was recommended, provided they were only located here for a short time; but if the locality were occupied for a lengthy period, the results were not so good. On the whole, in this war, however, the reports are almost all favourable to this method of treatment.

Coming now to our own countrymen, Bryson reported excellently on the prophylactic effects of quinine. On the West Coast of Africa, on the Gambia, Harvey found, however, no good results to occur. The blue jackets who took quinine daily had as much fever as the men who did not.

The late Surgeon-Major Parke, ten days before entering the mouth of the Congo, gave the officers four grains of quinine three times a day. There were only two cases of slight intermittent fever, although 350 miles of the most unhealthy region were passed through. No other white man had previously travelled the same country with the same immunity. My late friend, Dr. Ralph Leslie, whilst acting as Government medical officer in the Congo Free State, gave a protracted administration of arsenic, by interrupting it during fifteen days every six weeks. Every one who had gone regularly through the cure was preserved from severe attacks of fever. Dr. Crosse of the Niger Company has again had favourable results from the exhibition of quinine. At Peshawar, 1866, during the autumn, the different corps were divided into wings, the men in one wing having five grains every evening, the men in the other having none. From September 1st to November 30th 1,203 men took quinine, with an admission into hospital of 10·22 per cent. for malarial fever; 1,202 men who took no quinine had an admission rate of 27·28 per cent. of fever.

There is, however, evidence of a contrary kind. Thus Sir Anthony Home did not consider quinine thus given to have had any value. In the Malay war again a daily issue of three grains was ordered. The Gurkhas did not receive the ration, and yet they suffered only very slightly more than the Buffs who took it. But among the Buffs, the malarial fever which did attack the corps appeared one month at least after they had been regularly taking it.

I am afraid, gentlemen, I have wearied you with this recapitulation of the result of prophylactic issues. I will, therefore, conclude my paper with a brief resumé of the data I have myself gathered in this direction. The men from whom my results have been obtained are Sikhs and Gurkhas. Therefore no disturbing elements due to race or station are involved. They have all been at the time of the same race and of the same station. The drugs I have given have been quinine, quinetum, cinchona febrifuge, cinchonidine, sulphur, arsenic, and atees. Atees I may mention I chose, as on enquiry from my Hospital Assistant I found this was a favorite drug among the native community for ague.

With regard to arsenic, I have derived no benefit from it. During 1886 and 1887 I placed the men of the regiment I was serving with on a prophylactic ration of arsenic during the months most liable to malarial fever.

In 1886, four companies of the 23rd Pioneers were ordered arsenic, commencing with 5 minims twice a day, and finally taking 10 minims of the liquor three times a day. From August to December there were total cases of malarial fever 54. In the companies taking arsenic 28 cases occurred; in the companies not taking it 26.

In 1887, the men of the 14th Sikhs were subjected to a similar treatment from September 20th to November 16th. The right wing took 6 minims of the liquor twice daily; the left none. The right wing had eight cases of ague; the left nine.

In 1889, whilst in charge of the 14th Sikhs at Peshawar, the regiment having suffered to an unusual extent from malarial fever during the preceding year at Jhelum, I again tried the prophylactic effect of arsenious acid from August 16th to October 30th. From August 16th to September 15th, C. and D. Companies took 7 minims of liquor arsenicalis twice a day; from September 15th to September 20th this was increased to 10 minims; from September 20th to October 7th the dose was 12 minims, and from the latter date to October 31st the men took 15 minims twice a day. Compared with the companies not taking any prophylactic, the results are as follows, the number of men in each company being practically the same:—

	Malaria fever.	
C. Co. ...	... 24	cases.
D. Co. ...	... 16	,,
E. Co. ...	... 24	,,
F. Co. ...	... 17	,,
G. Co. ...	... 21	,,
H. Co. ...	... 13	,,

Here again, therefore, arsenic effected no prophylactic effect; if anything the companies not taking it were rather freer from malarial fever. Thus the malarial fevers in India are either not so amenable to prophylaxis by arsenic as those of Italy, or else the form in which the preparation was given was the cause. Tommasi Crudeli does not recommend the liquid preparation of arsenic, but gives the drug in the solid form in gelatine tablets. With regard to *quinetum*, the companies taking it were unfortunately placed on it from October 11 to the end of the month, and not having had any prophylactic previously, the results obviously are not sufficient to draw any conclusion from.

Turning now to the effects of quinine and cinchona febrifuge, A and B Companies from August 2nd to October 31st took respectively three grains, increasing in the last week to five grains of quinine and cinchona febrifuge. Up to the week ending October 10th, when E., F., G. and H. took quinetum, the results were:—

A. Co.	taking quinine	... 10	cases malarial fever.
B. Co.	taking C. F.	... 11	,, ,, ,,
E. Co.	taking no drug	... 24	,, ,, ,,
F. Co.		... 18	,, ,, ,,
G. Co.		... 21	,, ,, ,,
H. Co.		... 13	,, ,, ,,

Here we see therefore a decided prophylactic effect was exercised. Finally, coming to the results obtained this year amongst the 1-3rd Gurkha Rifles with quinine, cinchonidine, sulphur, arsenic and atees I regret to say that I have none of any value to offer. Almora seems to be remarkably free from fever. As a matter of fact, the admission from fever have been remarkably small, and the companies not taking prophylactic medicine have shared equally well as regards fever with those taking it.

The result of my experience is then that of all the drugs named, quinine and cinchona febrifuge are the only ones that have exercised any influence. By this means certainly a certain proportion of men have been enabled to perform their duties, and thus their services not lost to the army. Under these circumstances I would therefore urge that in all campaigns involving a sojourn in a malarious district, prophylactic issues of either of these drugs be ordered. Quinine is now manufactured at a much cheaper rate than formerly, and the services of our men could thus, at a slight expense to Government, be preserved intact to the army operating in the field.

WHAT IS REMITTENT FEVER?

BY N. N. KATRAK, L.M. & S.,
Bombay.

In the Mortuary Returns of the Health Officer for the city of Bombay for the year 1893-94, it is stated there that 21 deaths are due to enteric fever, 831 to simple continued fever, 262 to ague, and 4,730 to remittent fever. The question arises what is meant by remittent fever. It is well-known that intermittent fever becomes exaggerated, and intermissions are converted into remissions, but these cases yielded to quinine as readily as the ague; besides during the remission, though the temperature does not go down to the normal, still there is a considerable descent from the highest point reached, and symptoms are abated during that period; but such cases are few and far between. The bulk of them does not yield to quinine, nor do the symptoms abate during remission. It is a misnomer to call the little dip in the temperature which we find in these cases a remission. There are slight variations and nothing more, such as are found in a continued fever, hence they cannot be of the nature of ague, *i.e.*, amenable to quinine, and containing the same bodies (Laveran's). That these cases were hitherto, and even now are by some, regarded as due to the same poison as that of the ague is evident from the fact that large and even heroic doses of quinine were, and in some cases even now are, administered in such cases; but this practice is becoming less frequent every day. Again, those cases of remittent fever, which do not yield to quinine, are by some regarded as cases of typhoid fever, as will be seen from the following para. quoted from Sir William Moore's Disease of India, second edition, page 285:—

"Deputy-Surgeon-General Pinkerton, several years the able Surgeon to the European General Hospital, Bombay, states he is quite sure that what we now call the enteric fever has existed over 50 years in Bombay, and has been known as 'the 21 days' bad Bombay fever.' The same authority informs me of his opinion that the disease is in every respect as in Europe, and that it has no connection with malarial fever, taking ague as the type; also that enteric fever exists all over Western India, killing an enormous number of natives under the name (in the Mortuary Returns) of remittent fever, or simple fever. With Dr. Pinkerton's views as to the indefinite existence of enteric fever in Bombay, as to its being the same phase of disease as seen in Europe, and as to its causing great mortality among the natives I fully agree; but I believe it to be simply a phase of fever and not a specific disease of pythogenic or miasmatic origin."

This opinion, however, does not seem to have received universal acceptance, as in the Sanitary Commissioner's report the bulk of cases are still included under the heading of remittent fever. Even among Europeans troops the admissions for enteric fever were only 1,362, as against 22,749 for remittent. Among the native troops only 33 admissions are put down for enteric fever, as against 54,347 for remittent fever. Again, in well-conducted hospitals, such as the Goculdass and the J. J. Hospitals, the proportion of typhoid fever to remittent fever is extremely small. In the Goculdass Tejpaul Hospital from 1888 to 1892, no admission has been recorded under the head of enteric fever, whereas for the same period the admissions into the J. J. Hospital are 17 cases of typhoid fever, as against 2,526 of malarial. I believe that it might be safely said that the bulk of the remittent fever cases cannot be and are not regarded as cases of typhoid fever in accordance with the views of Surgeon-General Pinkerton and Sir William Moore. Then the question still remains, What is remittent fever ? It is by some regarded as modified typhoid ; but to say the least the term is very vague. It is not quite clear what the term modified typhoid fever means. It may mean that the germ is the same germ, namely, Eberthgaffky, but it does not produce the same symptoms as are found in the true enteric. But the presence of this germ in cases of remittent fever has not yet been established, and it is not quite clear in what way the system has been modified to produce different symptoms, and it is open to question whether, in the absence of enteric ulcers and characteristic eruptions, it is quite justifiable to call it typhoid. Again, it may mean that the germ is modified, that is, it may be a stronger or weaker germ, in which case we should expect the symptoms to be more or less pronounced, but of the same nature. It is, however, found that this cannot be the case, as true cases of typhoid fever are produced, and the germ, that is, typhoid bacillus, is obtained in India. So modified typhoid as a scientific expression must be discarded. Others name it typho-remittent fever, implying thereby that the poisons of typhoid and of malaria enter the body at one and the same time and produce their combined effects, and that according as the one poison is more active than the other in the system, the symptoms produced by that poison predominate over those produced by the less active poison. It is not quite clear which of the signs and symptoms in a case of remittent fever are to be attributed to malarial poison and which to typhoid poison. Broadly speaking, fever symptoms may be divided into general symptoms and special symptoms. General symptoms are common to pyrexia, such as heat of the body, frequency of pulse and respiration, interference with the functions of the various organs, and disturbance of the nervous system, such as headache, pains in the body, and in severe cases acute or low delirium and typhose condition. The special symptoms are the course of the fever, temperature chart, the onset and the termination and specific lesions. Now typhoid fever will produce the same general symptoms as those of malarial fevers. They are, however, more violent, because the temperative is higher and more persistent, and the poison is of a more virulent character. The special signs and symptoms are enteric ulcers, peculiar eruptions, peculiar character of stools, and a period of 21 days. There is also to be found typhoid bacillus. In malarial fever, the special characteristics are the peculiarity of the onset and the decline, the three characteristic stages, the cold, the hot and the sweating, the periodicity and the amenability to quinine, and there may be found Laveran's bodies in the system. If the term typho-remittent is to be applied to these cases of remittent fever which do not yield to quinine, the question arises, where is the combination of the symptoms ? All the symptoms special to the malarial fevers, namely, the three stages, periodicity, as well as the amenability to quinine, are entirely wanting, nor do we meet with enteric ulcers or the peculiar eruptions. Even the period of 21 days, though present in some cases, is not universally found. This term is also inapt, inasmuch as it puts one on the wrong scent, and is based on unsatisfactory data. My impression is that the term at one time was applied to cases of remittent fever, in which typhose condition supervened ; typho then was an abbreviation of typhose condition, and not of typhoid fever. This view that the remittent fever (excluding cases purely of an ague type) is due to the two poisons getting into and acting in the body at one and the same time is in my opinion untenable. The question then still remains unanswered, *i.e.*, what is remittent fever ? To me it appears that it is a distinct fever entirely different from malarial remittent on the one hand and the enteric on the other. It is in many cases found that the beginning of this fever dates from the inhalation of severe gas. In many cases wherever it was possible I have elicited from the patients the important information that the beginning of this fever was due to this gas. This is what the patient says : " Returned home as usual with nothing particular added to the daily routine ; all of a sudden got a bad smell that made me uncomfortable ; after that I felt some vague but trifling pains in the body and unaccountable depression. This state of thing lasted from two to four or more days." After which the course of the fever is as follows : He begins to feel hot, without any shivering or rigor, temperature in the beginning does not go above 101° F. and continues with slight variations to rise till the fifth day, when generally it reaches its highest point, which is sometimes as high as 105° F. It then continues with variations of a degree or two. At this height for about six days in some, eight in others, or fourteen or twenty-two in the rest, when it terminates by lysis. It will be seen that the full course varies from eleven days to twenty-eight days according to the course it gives. We have four varieties of eleven days, fourteen days, twenty-two days and twenty-eight days. It is accompanied from the very beginning with extreme physical discomfort and prostration out of proportion to the height and duration of the fever. Sometimes there is acute delirium, followed by low muttering delirium in fatal cases. There are no eruptions and no abdominal tenderness or gurgling, stools when passed are healthy, and the face is pinched instead of having the bright circumscribed flush. There are also other symptoms of an adynamic character, such as are found in other cases of fever. This sketch will show that, except that the temperature chart is to a certain extent similar to that of typhoid fever in some cases, though not in all, there are no symptoms which are found in the enteric, nor are there any symptoms which can be referred to a malarial origin. As I have said above this fever is a distinct, though unnamed fever, caused by some poison of microbic origin conveyed by sewer gas. It is possible that in the decomposing animal dejecta pathogenic germs of more varieties than one may be present, and that the fever we are considering may be due to the one or the other, but it is not identical with the typhoid poison, nor has it any connection with the poison of the fever of the ague type. It may be said that this is a question more of an academic character, but even if it were so, in the interest of science, we would be perfectly justified in finding out the truth about this matter. However, it has a practical significance of a most important character. If the case should be of a malarial origin, one would be justified in pushing quinine to its fullest extent ; if not one is not justified in dosing his patient with a drug which has in large and heroic doses a depressant and injurious effect. If it is typhoid fever, one has to be very careful about the diet of the patient. If it is a distinct fever by itself, as I regard it, then our duty lies in striking out a new path, if possible. This question was discussed in Bombay in a series of meetings of the profession convened by the Grant College Medical Society, and has been referred to a Committee, and it is to be hoped that the investigation of the Committee will be of a decisive and practical character.

The conclusion at which I have arrived is that the cases included under the term of remittent fever cases are not all due to one and the same cause. There are a few true remittent fever cases of the ague type, which readily yield to quinine. The bulk of these cases, however, are due to some cause of a microbic origin, which has its habitat in decomposing animal dejecta, and that there are probably more than one variety of these germs which produce more than one variety of cases.

DISCUSSION.

1. *E. Hart* (London) said what was wanted was searching enquiry into the *causes* of Indian fevers, evidence as to the nature of Laveran's organisms in the blood and their distribution, &c. ; and how they could best be combated. No man should get up and say he *inferred* the presence of an organism ; he should have looked for it and seen it or not, but never infer anything about it. In Baltimore different organisms had been found in different types of fever, and it was whether these organisms were found in India that was the most important question before the section.

2. *S. O. Moses* (Calcutta) said that in Calcutta, as in Bombay, there was distinct and specific fever known as remittent, which was quite different from those fevers where malaria complicated the disease. There might be a resemblance to enteric fever, but none of the typical signs of enteric were present, nor had the bacillus been detected. There was a great want of thorough investigation of the blood by the microscope, as well as *post-mortem* examinations, in these remittents. But inasmuch as there existed a pyrexial state and a remission as in cases of intermittent fevers due to an organism flourishing during fever and lying dormant during the intermissions, then reproducing itself, there is reason to believe that in remittents also we have an organism of like nature. The remittents run from one to three weeks. Keeping down the fever and feeding the patient would in many cases result in recovery.

3. *S. Haslet Browne* (Lahore) said his experience agreed with that of Dr. Moses in so far as it related to the existence of a form of remittent fever distinct from that due to the malarial parasite. He had recently had a large experience of fevers in the Mayo Hospital, Lahore, where they had been unusually frequent during the preceding two months, and whilst he had found it possible to recognise malarial forms by means of a microscopic examination of the blood and the recognition in it of Laveran's parasite, still there had been a certain number of cases where careful search, both by himself and more competent observers, had failed to yield other than negative results. It was the fashion in the present day to classify cases of non-malarious remittent fever as instances of irregular enteric, but he had failed to obtain any satisfactory evidence of the truth of this theory either by clinical study or by *post-mortem* examination in fatal cases. He might explain that the forms to which he was referring had occurred in natives of India, and two cases that had recently come within his experience would serve to illustrate, not only the means now placed at our disposal for the diagnosis of malarial fevers, but also the fact that a severe form of fever is met with in which the evidence of its being malarial in origin is at least unsatisfactory. Two male native patients were admitted to the Mayo Hospital early in December 1894, almost simultaneously. Both were suffering from high fever, the temperature ranging above 104°. Both became comatose (without hyperpyrexia) a day or two after admission, and both died. In one case large numbers of the crescentic form of the malarial parasite were found in the blood of the finger during life, and after death vast numbers were found in the blood of the spleen, while the capillaries of the brain cortex were found filled with what almost amounted to a pure culture of this form of the parasite. In the other case only a few of the ordinary endoglobular quotidian parasites were found after careful search in the peripheral blood during life and in the spleen after death. In this case no abnormal appearances were found in any of the organs except slight fatty degeneration of the liver and some engorgement (not amounting to inflammation) of the bases of the lungs, with very moderate enlargement of the spleen, which was not much discoloured. There was no ulceration or swelling of Peyer's patches. In both of these cases quinine was energetically pushed, being administered hypodermically, the dose reaching as high as 10 grains frequently repeated. It was clear that the first case was one of the pernicious forms of malarial fever, but that could not be said of the second. In neither was there the slightest possibility of isolation, as the weather in Lahore at the time was unpleasantly cold. The theory, so often put forward, that fevers of the kind he had been speaking of were caused by toxines produced in the intestines, seemed to him a probable explanation. These toxines might, or might not, be the product of pathogenic micro-organisms in the intestines, but at all events we had a possible source in the bacillus coli communis, which was generally believed to be capable of acquiring pathogenic properties under conditions associated with irritation of the intestines such as were of very frequent occurrence in India.

4. *H. Thornhill* (Ceylon) said that arsenic was most beneficial in chronic malaria, but as a prophylactic in cases of acute malaria it was inferior to quinine. He had had no experience

of the internal use of eucalyptus, but he knew that on plantations of eucalyptus in Ceylon malarial fevers were as prevalent as on other estates. In judging of the prophylactic value of different drugs, it should be remembered that the general health and condition of the different subjects should be considered.

5. *L. P. Gomes* (Bombay) beg to draw the attention of the meeting to the marvellous effects of inderjao (*Wrightia anti-dysenterica*) as a prophylactic in the treatment of malarial fevers and to its value as a preventative of secondary complications, especially of the liver. Dr. Duncan did not allude to the effects of the plantation of malarial districts with the eucalyptus and to the internal administration of that remedy. He also mentioned that a decoction of the sour lime had, in his experience, been found very valuable in simple uncomplicated cases of intermittent fevers, but not in severe remittents.

NASHA FEVER.

BY LAWRENCE FERNANDEZ, M. D.

THE object of this short paper is to lay before you a few notes, regarding a disease which is very common in this Province, but which has not been considered important enough to have attracted the attention of European writers, for in none of the text-books of medicine used in the medical schools in this country, or elsewhere, is there any reference made to the subject. The disease, however, is one which I feel merits our earnest attention, and I trust that I shall lay before you sufficient material to induce you to discuss the subject in all its bearings, and thus lead the way of stimulating the means of further investigation of the same.

Nasha Fever, the *Nakra Fever* of the N.-W.P., otherwise called *Nasha Jawhar*, is the subject of my paper. The native practitioners of this country, who practise the medical art, according to the ancient Sanscrit and Vedic systems, are quite conversant with the affection, and I shall quote you below passsages from ancient Hindoo and Sanscrit literature to show that they were conversant with it.

This fever is of a type peculiar to India, and is perhaps most prevalent in Bengal. Even the medical journal of this country have helped me very little, although, as I have said, the disease is really very common. It is characterised by a sharp attack of fever of a remittent type. It is sometimes intermittent; the temperature is always over a hundred degrees, even when intermittent. Preceding the fever, a peculiar characteristic congestion of the blood-vessels of the mucous membrane of the septum nares, as also of the Schneiderian membrane takes place. This congestion, even after the accession of the fever, is really what attracts attention. The congestion sometimes takes place on one side of the septum, and in other cases both sides are affected. There is very often no pain; the surface of the septum is raised, and presents a red appearance. Some practitioners in this country consider this swelling and the accompanying fever to be local manifestations of a slight congestion of the brain, and I, myself, am inclined to concur in this belief. Others consider the swelling to be a catarrhal condition of the mucous membrane of the nose. The usual symptoms of fever are present, marked constipation and malaise are very prominent, and the appearance of the patient may be well described as having a "hazy" or "smoky" appearance. The nervous symptoms are peculiar. There is great frontal headache, also severe pain at the back of the neck, shoulders. and small of the back. The pain is described by Indian practitioners as of a "biting" nature. Sometimes, the pain at the back of the neck is very severe indeed, and the accompanying symptoms of fever which are present reminds one of some of the symptoms present in tubercular meningitis. Here the face appears flushed, with a feeling of heat and fulness about the head. and the pupils are contracted. These symptoms continue from three to five days, when the swelling decreases and the fever subsides without any treatment whatever, excepting the regulation of the bowels by a purgative; the swelling never suppurates. On the sudden subsidence of the swelling which does occasionally occur, grave symptoms *sometimes* follow, the fever becomes higher, delirium, coma, and death; but such a fatal consequence is rare.

Occasionally with the fever and the nasal inflammation, an ill-defined rash appears on the body, rose-coloured, and in small patches, with which there is generally slight bronchial symptoms. Here the affection is confounded with measles and scarlet fever.

Diagnosis.—Although the nasal mucous membrane is swollen, there is frequently no pain whatever in the septum; the patient complains of a headache, pains about the body, and has fever. Very often he is not aware of there being present any inflammatory affection in the nose, and therefore does not complain about it, and the physician deals with the case as one of simple fever; but the persistence of the symptoms, and the appearance of the patient, leads to an examination of the anterior nasal cavities, and the real character of the affection is arrived at. No antiperiodic or antipyretic has any effect on the disease.

Prognosis.—It may be safely said that prognosis is mostly favourable, as there are very few cases which are not amenable to the treatment usually adopted. In some cases it is unfavourable, and here the disease may end fatally. One attack predisposes to another.

Age and Sex.—Both sexes are liable. Female are rarely attacked, and never before puberty; males not before the age of 13 or 14; children are never attacked. It does not occur after the age of 50.

Time of the attack.—Mostly prevalent between April and August. Seldom seen in the winter. The attacks appear at certain intervals—monthly, fortnightly, or even weekly.

Occupation and Diet.—All classes are liable, but the disease is most often seen in native fishermen, dhobies, gardeners, and dhangurs. Mahomedans in Bengal are not so prone as Bengalees. All occupations which expose to inclement weather induces the disease. It is believed that the eating of stale cooked rice with cold water, a practice very common among the poor in this province, as also the drinking of the water from young cocoanuts, and the eating of the very young palm, induces the disease, and anything which lowers the vitality predisposes to an attack.

Supposed connection with other Diseases.—The concensus of opinion amongst medical practitioners is that it is a purely local affection followed by the fever. Others believe it to be connected with a congested state of the liver; these latter say that they have known of cases where, on the subsidence of the nasal symptoms, their patients were troubled with hæmorrhoids; also that an active purgative in cases of *Nasha* is followed by immediate relief. This has been my experience only in one case out of many, in which, besides active purgation, I prescribed cold effusion.

Malarial Connection.—Opinions are divided, and some practitioners, under the belief that *Nasha Fever* is due to malaria, prescribe quinine, but this drug has no effect whatever on the disease. It is prevalent in malarious places, and here the fever which accompanies or follows *Nasha* is preceded by ague. Those who have had experience in these districts say that opium gives great relief, and that very often no other treatment is necessary. The disease is, however, met with in places where there is no malaria. Arsenic has no effect on the disease.

Pathology.—There is a congestion of the mucous membrane of the nose and frontal sinuses. The mucous membrane is slightly raised, but there is no inflammation. Following the congestion there is slight catarrh. Often on pressure there is a doughy feeling, but suppuration never occurs. There is no tissue change in the mucous membrane, which, however, assumes an hypertrophied appearance after repeated attacks. The blood which escapes consequent on a method of treatment commonly practised, and which gives immediate relief, is of a darkish colour and poor in plasma. Examination under the microscope of the blood shows an increase in the number of colourless corpuscles.

Treatment.—Quinine and arsenic have no effect on the disease. Opium relieves the pain in the neck, back, etc. Tartar emetic in doses to induce diaphoresis has met with good results, and I know of one case where both local and internal treatment failed to give relief, in which this drug was of the greatest service. A brisk saline purgative is all that is needed in the simpler cases. The usual method of treatment and that which gives the most relief is depletion, which is done either by (1) (as the natives do it) two bundles of *dhoob* grass introduced into the nostrils, ever which friction and outside pressure is applied against the septum; (2) by a few pricks of a needle; or (3) by a few punctures with a bleeding lancet. A small quantity of blood escapes and the sufferer is restored in a few hours to perfect health. This plan of treatment, however, is only palliative, and the great objection to it is that, if frequently done, it induces an hypertrophied condition of the mucous membrane but which has no effect in lessening the efficiency of similar treatment in future. Very often it is not safe to follow this plan of treatment, for, although it is generally followed by relief, end by a subsidence of the accompanying fever, yet in some instances the congestion, with all its train of symptoms, re-occurs. The local application of astringents, such as a solution of tannic acid, or a 10 per cent. watery solution of cocaine, has given good results in the hands of many practitioners. The application of *Akanda* juice (*Calotropis gigantea*) to the mucous membrane also gives relief. The febrile symptoms must be treated according to indications.

The plan of treatment I have adopted in cases which have come under my notice of a few Europeans and a number of natives is as follows: A brisk purgative, injection of cold water, cold effusion (injection of iced water up the nostrils), two or three times a day, with diaphoretics internally.

This line of treatment has invariably given me good results. Fever and nasal affection passing off within three or for days. In a few instances, however, high fever followed the subsidence of the congestion, and even delirium in one case.

Such is the brief history of a disease, which, as I have said, although very common in this province, has not yet received a place in medical literature. That it is well known to practitioners of this country there is no doubt. The *Kobirajes* and *Hakims* know all about it, and they apparently have been quite conversant with its existence for many hundred years. In one of the oldest Tantras there is found detailed, a discourse on Fevers by Siva, explaining the same to his wife Parwati, as follows:—

Parwati says: "Oh Mahadeva! thou perceiver of past, present, and future, Oh thou merciful God of Gods! thou who knowest all, tell me all about fevers; Oh! for the benefit of men tell me."

Siva: "Oh, Devi! hear the different forms of fever. A knowledge of them makes an adept physician. Fever is divided into two varieties: (1) that which begins with rigor; and (2) that which begins with heat. These again are divided into four, where they terminate by collapse and delirium. These four varieties are sub-divided into twelve other forms produced by impurities of mucus, bile, and phlegm.

"That which begins with cold (rigor) is divided into non-eruptives and eruptive fevers.

"The non-eruptives are periodics—daily, quotidian, tertian, and quartan agues.

"The eruptives are: The typhoid, the plague, *Nosha Jawhar*, and the epidemic of small-pox."

Siva continuing says: "Oh Devi! *Nasha Jawhar* shows itself at the nostrils, they become occluded, the pulse becomes irregular (like the leaps of a frog), temperature increases, there is severe headache, soreness of the eyes, constipation, dysuria, and delirium. The mouth, palate, throat, and lips are dry; there is a running from the nostrils, pain in the back, flanks and abdomen. After fifteen days the severity subsides, but the first three days are the worst through which the patient passes, when the disease reaches its crisis, and the patient either passes into convalescence or the disease ends fatally."

Again, in the *Ayur Veda* it is stated, "that *Nasha Jawhar* originates from disorder of the bile in a phlegmatic constitution. The swelling in the nose is like the flake of an onion, and it appears either in one or both nostrils. It is always attended with more or less fever, and pain all over the body, especially in the nape of the neck and forehead. Scarification is the treatment."

NÁSÁ FEVER (NAKRÁ.)

BY NARESH CHUNDRA MITRA, M.A., M.B.

It is a disease peculiar to India and affects the nasal mucous membrane. As no European text-books of medicine make any mention of it, it may be presumed that it does not prevail in Europe. In Bengal it is called *Násá* fever, while in the N. W. P. and Behar they call it *Nakrá*. How far the sister provinces of Madras and Bombay are effected is very difficult to find out, as no one has yet taken the trouble to do so. It may be hoped that definite opinions as to the point will be forthcoming, and that a solution of the pathology of this Indian disease will be arrived at to accord it a place in the European systems of medicine.

It is a congestive fever with the local manifestation of congestion or turgescence of the blood vessels of the Schneiderian membrane of the septum nares. It is not inflammatory.

Anatomical Characters.—There is a small localized swelling which is confined to the septum of the nose on one or both sides of it. The swelling is of the size of a big pea. It fluctuates on pressure and is not painful in the least.

Symptoms.—From the beginning the patient complains of a sensation of *malaise*, excessive frontal headache, a sensation of heaviness all over the head, dull pain all along the spinal column, both the shoulders and the back of the neck. The bowels are costive, the tongue coated, and dull appetite. The attendant fever is not very troublesome; ordinarily it ranges between 99° and 102°; sometimes it may go up to 105°F., but that is rare. The fever is of an irregular type; in some cases it is remittent, in others intermittent. There is no definite duration for the fever. There is no catarrh of the nose. The mucous membrane is red, congested, but not swollen. There is a complete absence of any uneasy sensation referred by the patient to the part affected, and this is very curious considering that the nasal mucous membrane is peculiarly sensitive to the tiniest foreign particle. The swelling never suppurates.

Relapses are very common, so that old sufferers are sure to have *Násá* whenever they are any way indisposed, and this indisposition rather follows the reappearance of the growth than anything else.

"If the fever be very high, delirium follows, coma supervenes and the disease may carry off the patient, but this fatal termination is very rare." Some practitioners have noticed that on the subsidence of a *násá*, the patient is troubled with hæmorrhoids and *vice versâ*.

Diagnosis.—An examination of the nose clears up all difficulties. The lingering pains, the dull headache, the malaise are sufficient landmarks for old sufferers and experienced physicians for a correct diagnosis.

Prognosis.—Always favourable, except in some rare cases.

Treatment.—No internal medicine has the slightest effect in checking the fever. Some think the disease to be malarial and give quinine, but without any appreciable benefit. For relief of the pain, bromide, chloral, cannabis indica and caffein citras may be of use. Some have found tartar emetic to give relief.

Local treatment is the only measure to combat with the fever. Puncturing the mucous membrane at the site of the swelling is followed by free hæmorrhage. The patient experiences great relief—the pain rapidly diminishes, the fever goes off in a day or two, and the patient gets free from any complaint. The puncture must be made rather freely, otherwise, if insufficiently done, the opening closes up and it has to be reopened a day or two later. But most people object to puncturing as they have to undergo a like operation in future attacks. They prefer *caustic* to *puncturing*. The *caustics* used are the solid lunar caustic or the milky juice of *akand* (Mudar). Some recommend cold effusion and the application of tannic acid to the part; others, friction by two pieces of *dhoob* grass directed against the septum. The blood which oozes out of the swelling is of blackest-red colour, and it trickles out in drops as pressure is being applied to the temples and the spinal column. The *Kabirajas* advise application of mustard oil to the affected part to prevent recurrence of the disease.

DISCUSSION ON NASHA FEVER.

D. N. Roy (Calcutta) said this condition was found in all cases of fever, whether zymotic or malarial. It was not a disease by itself, only a symptom. The Schneiderian membrane was congested, and local bleeding relieved the uncomfortable frontal headache; but one operation would not bring the expected relief, it would have to be repeated. People with weak hearts would be troubled with this local congestion when they get bronchitis, and a little bleeding from the Schneiderian membrane would relieve them immensely. Patients with small-pox, chicken-pox and measles do get local congestion of this membrane, and the local symptoms are in no way different from those described by the readers of the papers.

K. C. Bose (Calcutta) was of opinion that the so-called nasha fever was nothing else than the ordinary febricula. The outcome of constipation or exposure under a hot sun: the duration of the fever was three days, and the majority of cases recovered without any special treatment. He had seen many cases, where the symptoms were promptly relieved by a brisk purgative. He had never seen a case where the fever had produced alarming brain symptoms. The occurrence of severe headache was easily explicable by physiological rules. Nasha fever is a disease of young adults and the middle-aged. It has never been observed in the very young nor very old. He expressly stated that, in his opinion, nasha fever did not require a separate place in the nomenclature of Indian diseases.

SECTION

OF

SURGERY AND OPHTHALMOLOGY.

PRESIDENTIAL ADDRESS ON THE INFLUENCE OF PERCIVAL POTT, SYME, SIMPSON AND LISTER ON MODERN SURGERY.

BY EDWARD LAWRIE, M.B., M.R.C.S.,
Surgeon-Lieut.-Colonel, I. M. S.

GENTLEMEN,—I feel the distinction of being selected to fill the important post of President of the Surgical Section of the Congress as the very highest honour that could have been conferred upon me. At the same time I may say, without affectation, that I am almost overpowered by the sense of my unfitness to fill that position, and fear lest I may disappoint many of you in the remarks I am about to make.

In surgery I am strongly conservative, and there are many men in our service in India who have far higher claims to be considered scientific surgeons, and who would have done far greater justice to the developments of modern surgery than I can do. On the other hand, I am convinced that the experience you will bring to bear upon the many important surgical questions which will come before the Congress will have lasting consequences in the future, and will much more than atone for the shortcomings on my own part to which I have referred. The only thing I ~~can~~ say in my own favour is that I am a staunch admirer of British surgery, and especially of British surgery in India. I find it impossible to over-estimate the value of what I learnt in general surgery, and also about chloroform, from Partridge, who was the Professor of Surgery in the Medical College here when I first came to India. I have never seen more perfect operations for cataract than those of J. B. Scriven, of Lahore, nor sounder and more brilliant abdominal operations—not even excepting those of Knowsley Thornton—than those of Branfoot, of Madras, and Joubert, of Calcutta. Further, I venture to assert that the surgery which has been done in the North-West of India during the last 20 years by Freyer, Sanders, Keegan, Geoffrey Hall, Willcocks, Perry, the Neves in Kashmere, and a host of others, as well as by the men they have taught, has done and is doing more to establish kindly and friendly relations between the natives of England and the natives of India, than any of the numerous beneficient enterprises which have been fostered by Government for the benefit of the people and the country since India became part of the the empire of the Queen. Finally, I may relate, with I hope pardonable pride, and which I trust will be shared by the Government of His Highness the Nizam, a piece of surgery which has just been done by one of my own pupils.

This youth, till lately an Assistant House-Surgeon at the Hyderabad Head-Quarters Hospital, performed a Listerian ovariotomy successfully, at a lonely outstation in the district, with no other assistance than that of a compounder and two coolies. One of the coolies gave chloroform, the other looked after the instruments, sponges, lotions, dressings, and the irrigator; and the compounder acted as first and second assistant combined.

Gentlemen,—I have thought long and anxiously over the problem of the best way of occupying the time at my disposal for the delivery of the formal address on surgery before this the first Indian Medical Congress. The conclusion I came to was that we cannot do better than consider the influence of four great British surgeons on Modern Surgery—Percival Pott, Syme, Simpson and Lister. I have chosen these names from among the numerous great names there are to select from, for many reasons, one being that they are the four whose lives, writings, and example I know best: and further because they are Englishmen, and no other country that I know of has produced four men who have accomplished so much as they have for surgery. Percival Pott represents the surgery of the latter half of the eighteenth century. He resigned the office of surgeon to St. Bartholomew's Hospital in 1787. Syme and Simpson resigned their posts of professors of clinical surgery and of midwifery respectively in the University of Edinburgh, nearly a hundred years later. Pott and Syme both served their schools, as Pott used to say of himself, "man and boy," half a century. In one of his well-known tracts Pott says: "Our fathers thought themselves a great deal nearer perfection than we have found them to be; and I am much mistaken if our successors do not, in more ways than one, wonder both at our inattention and our ignorance." We must admire Pott's modesty; but when we think of the work accomplished by him, by Syme, and by Simpson, we cannot help wondering at their genius, their skill, and at the imperishable principles of surgery they have handed down to us and to our successors. The last of the four, Sir Joseph Lister, is still with us, and we all know that his work constitutes the subject we are about to consider chiefly to-day, namely, modern surgery.

Up to the time of Pott the state of surgery was imperfect. Operations were unnecessarily painful. The maxim, "*dolor medicina doloris*," was accepted as fully demonstrated. Dressings were painful, the actual cautery was prepared as a part of the necessary apparatus when the surgeon paid his daily visit to the hospital; and the natural processes of healing were either not recognised or disregarded. Pott's biographer states that he lived to see these remains of barbarism set aside, and a more rational plan, of which he was the chief author, universally adopted. Pott did not commence to write until the year 1756, when he was over forty years of age, and had acquired a vast amount of experience in surgery. Between that time and the year 1787 his writings were numerous, and many surgical conditions which he was the first to describe, such as fracture of the fibula with dislocation of the foot, and angular curvature of the spine, will always be known by his name. He wrote what he called "tracts" on many diseases in surgery, and not only accurately described them for the first time, but also laid down principles for their treatment which held good to the present day. There is unfortunately not time to do more than enumerate the subjects on which he wrote, and is still an authority, such for example as curvature of the spine, hernia, polypus of the nose, cataract, hydrocele, injuries of the head, fractures and dislocations, compound fracture, diseases of the rectum, chimney sweep's cancer, senile gangrene, amputation, and so forth. Pott was singularly successful with the trephine, and his essay on injuries of the head is well worth careful study in connection with recent advances in brain surgery, for which we are so much indebted to the splendid work of Ferrier and Victor Horsley. Pott discovered that when the bone inflames after a blow on the head, and a puffy inflammatory swelling makes its appearance in the scalp covering it, this generally indicates that there is a similar inflammatory swelling exactly opposite the same spot, on the inside of the cranium, which may be relieved by laying on the trephine. Pott published a most interesting and remarkable series of cases of head injury, numbers of which were lost from simple inflammation and pressure, or from sepsis. There is very little doubt that most, if not all, of the cases to which I refer would have recovered if he had known the secrets of antiseptic surgery, which we shall see later, he very nearly stumbled on to accidentally, and the modern use of antimony in the prevention of simple inflammatory conditions. When inflammation of the contents of the skull threatened to arise after injury of the head, Pott's only available remedies consisted mainly of phlebotomy and the trephine, and he certainly used them most freely. Where he employed phlebotomy and the trephine in cases of threatened intra-cranial inflammation, we now use antimony, either in good big doses at long intervals, or in small doses frequently repeated, and if it is a simple uncomplicated inflammation, the antimony very often cuts it short and saves the patient's life and obviates the necessity for an operation.

Before Pott's time *fistula in ano* was treated on a principle advocated by Cheselden, by first dilating the sinus with sponge-tents, then one of the blades of a large pair of forceps was to be thrust up the sinus, so that it and the other within the intestine pinched it between them. The piece so pinched was next to be snipped out by repeated attacks with a knife or a pair of scissors. As Pott says: "A very tedious and painful operation this must necessarily be, and from Mr. Cheselden's account not always successful." Pott rescued the operation for fistula from the domain of undue severity and uncertainty, and placed it on the footing it occupies to this day. He says: "The curved probe-pointed knife, with a narrow blade, I have always found to be the most useful and handy instrument of any. This introduced into the sinus, while the surgeon's forefinger is in the intestine, will enable him to divide all that can ever need division. The probe point of the knife will be received by the finger in ano, and will thereby be prevented from deviating, and, being brought out by the same finger, must necessarily divide all that is between the edge of the knife and the verge of the anus, and lay the two cavities of the fistula and of the intestine into one."

In the same way, with the operation for *internal hæmorrhoids*, Pott shewed that the proper principle to employ in removing an internal pile, is to ligature it just below the middle, and not at its base, or by pulling it bodily with part of the mucous membrane from which it grows, through the noose, and then tying it. If you look at the diagram, you will see that the wound left by the separation of the ligature in Pott's plan is no larger than the knot, and as it never gapes, it heals up in a few days after the ligature comes away on the fourth or fifth morning; whereas it is also plain that the wound, when the base of the pile, or worse still when mucous membrane is included in ligature, is necessarily a gaping one, and may take months to cicatrise. As in the case of fistula the principle of Pott's operation for piles holds good at the present time, whether the ligature, or the clamp, or crushing, or any form whatsoever of excision, be employed for their removal.

It must not be imagined that piles and fistula are diseases of too trivial a nature to demand our serious notice. They cause an immense amount of misery and suffering in the world, which can only be properly alleviated by treatment founded on correct principles. It is well to remind ourselves occasionally of correct principles: for a very few months ago, there was a proposal in the *Lancet* to revive Cheselden's operation of excision for fistula, and only last year a gentleman of my acquaintance came out from England, who was compelled to undergo treatment for four months after he landed in India, while an indurated wound in the rectum, due to the removal of too much tissue in an operation for internal piles, was healing up.

I much regret that time will only permit me to draw your attention to one more subject in surgery on which Pott left the record and stamp of his genius. I allude to *fractures*, and it is curious to note that almost every word he wrote on the principles of their treatment, more than a hundred years ago, is true to-day. He begins his tract on fractures and dislocations with the following quaint words: "No part of surgery is thought to be so easy to understand as that which relates to fractures and dislocations. This is the opinion of a considerable section of the general public. They regard bone-setting as no matter of science: as a thing which the most ignorant farrier may became soon and perfectly master of: nay that he may receive it from his father and family as a kind of heritage." In the treatment of fractures, Pott insisted on the importance of setting the fracture, at the earliest possible moment after their infliction, and that it is wrong to wait for pain and swelling to subside, as these and other symptoms of the injury are due to, and are best remedied by rectifying, the faulty position of the broken fragments. But the pre-eminent principle we owe to Pott is that, considered abstractedly, neither extension nor counter-extension can ever be necessary on account of the mere fracture, *i.e.*, on account of the mere fragments, of the broken bone, which, if left to themselves, remain just as motionless—just as absolutely still, and with as little tendency to move—as these pieces of bone on the table. Pott shewed that nothing can move the fragments of a broken bone but the muscles which are attached to them, and that the difficulty we meet with in making and in keeping up extension of the broken limb proceeds from the muscles only. To extend the muscles by putting the limb into that position which puts them into a state of tension is, if not to irritate them and cause them to offer resistance, at all events to give them their greatest power, whether of displacing the fragments of the broken bone, or of opposing their reduction or setting. On the other hand, putting a limb into such a position as shall most relax the whole set of muscles belonging to, or in connection with, a broken bone, must bestanswer the purpose of incapacitating the muscles from acting upon it, and must remove the resistance they have it in their power to make attempts to reduce or set it. It follows that such a position of the broken limb as will best relax the muscles must be the best for setting the fracture and for keeping it set afterwards.

A moment's reflection will prove to you that this is generally the position which the patient naturally puts a broken limb into, in order to obtain ease until he gets proper assistance. Pott insisted, and we all know it to be true, that when people are brought to hospital with the femur broken, we seldom or never find them lying in the *dhoolie* or palanquin with the leg and thigh straight and resting on the calf and heel; but, on the contrary, we almost always find them with the knee bent and the broken thigh lying on its outer side. Pott treated fractures of the thigh in this position, and I recollect Stromeyer, when he visited Netley, describing the evil results of extension in the treatment of fractures during the Franco-Prussian War, and stating positively that the position described by Pott, without splints, gave infinitely better results than extension and appliances made immoveable by starch, gum, or plaster of Paris.

It is, of course, true that the extension by immoveable appliances can only be intermittent, and that moreover we now have the pulley and weight with which to maintain continuous and non-irritating extension in fractures of the thigh; but it is a question of some importance how far this method could be employed in military surgery or in time of war, and it is a method which is certainly not applicable to any fractures but those of the femur. In the upper extremity, Pott's principle is even more obvious than it is in the lower, and yet I see it stated in the last new text-book on surgical anatomy that the proper way to set fractures of the arm is to extend the limb. Pott states that with the arm extended the difficulty of setting a fracture is very great, and it is very painful to the patient; while if the arm be kept in the extended straight position, the fracture will inevitably be displaced and lie uneven. But we now can go much further than this. There is no fracture of the upper extremity which is not practically set by simply raising the arm and flexing the forearm. Fractures of the upper extremity of the shaft, and of the lower extremity of the humerus, as well as all fractures of the forearm, including that of the lower end of radius, are all set by this easy manipulation. In other words, directly the forearm is bent in any of these fractures, and the muscles in connection with the broken bone put out of action, there is no more real difficulty, and hardly any more pain, in placing the ends of the broken bone in apposition, and keeping them so, than in doing the same thing to the fragments of the broken humerus which I hold in my hand. The knowledge of this fact is the key to the simple and easy treatment of fractures. No doubt the surgery of broken limbs is susceptible of improvement, as, for instance, by Landerer's method, by rapidly hardening the callus by massage and movement of the neighbouring joints, but Pott's principles can never for a moment be lost sight of.

The general position with regard to fractures then comparing Pott's day with our own, is this: The obstacles to the setting of fractures is the action of the muscles. In Pott's time there were two available means of overcoming or counteracting this action, namely: (1) extension, and (2) position; and Pott proved that extension is both unnecessary and painful. Modern surgery is armed with three ways of doing the same thing, namely: (1) extension, (2) position, and (3) chloroform. If extension is employed, chloroform ought to be given in the setting of all fractures; but if position is relied upon, and it is entirely sufficient, the pain is so slight that chloroform is unnecessary in the setting of any fracture, but the one exceptional fracture of the thigh. Not the least interesting feature in the connection between Pott's principles of fracture treatment and modern surgery, is the fact that the great surgeon himself once sustained a compound fracture of the leg. Amputation was decided on at a consultation of the St. Bartholomew's Hospital Staff, and was within an ace of being performed, when the opinion of one alone of the consultants prevailed, and the limb was preserved. The fracture then united without inflammation, exactly like a simple fracture, and Pott attributed this happy result to the circumstance that, when the protruding end of the broken tibia was reduced, the valve-like opening of the soft parts closed behind it in such a way that the entrance of air into the wound was prevented, thus accidentally foreshadowing, a century in advance, the scientific aseptic method of the immortal Lister. In 1866, exactly 110 years after Pott's accident, which so nearly led him to the discovery of Listerism, Lister himself treated a compound fracture in the Glasgow Royal Infirmary by methodically preventing the entrance of air into the wound by means of an artificial scab of lint, blood, and carbolic acid; and in this way he opened up the new era, which we call, and which is in truth, modern surgery.

The connecting link between Percival Pott and modern surgery is Syme. Pott died in 1788, Syme was born in 1799. Throughout his career, which ended in 1870, Syme upheld and consolidated Pott's surgical principles. But he was not the man to follow any beaten track, and during the fifty years he practised and taught, he introduced many new measures into surgery which will perpetuate his name as long as medicine lasts. In 1823, when barely three and twenty years of age, he performed amputation at the hip-joint for the first time in Scotland; and in 1829 he excised the whole of the upper jawbone for the first time in Great Britain. A report of the latter case reached the *Lancet*, and was published with the following editorial note in a bracket: "We need no ghost from the grave to tell us what has become of the patient," but a month later the *Lancet* had the pleasure of recording his complete recovery. Syme established the operation of excision of joints in England: his operations on aneurisms have never been surpassed in boldness and originality: he shewed that amputation of the whole arm with the scapula is a feasible procedure; and he was the first surgeon in England who successfully removed the whole tongue.

It was not alone in great things that Syme excelled. It is to him that modern surgery owes the simplest and most perfect operation for harelip: the only faultless amputation known, that of the foot by the heel-flap; and the easiest and most lasting method of curing organic stricture of the urethra. In harelip Syme demonstrated that the way to close the gap, and at the same time make an absolutely straight lip, without any inequality or notch, is to entirely remove the margins by an incision which terminates on either side in the straight part of the lip quite beyond the angles of the gap. This plan is applicable to all cases of the deformity, single or double, and in no other way can a perfectly straight lip of uniform thickness throughout be obtained. This is a photograph of a case of double harelip operated on by Syme's method seven years ago, in which the cicatrix in the prolabium has unfortunately become effected by keloid. Not only is there a full in, straight, and without even the slightest trace of a notch, but you cannot see any sign whatever of cicatrix in the lip itself, and curiously enough the keloid does not affect any part of the lip. In fact there is no cicatrix in the lip, and what cicatrical tissue there was, after the operation, must have been absorbed; otherwise it would have been affected by the keloid growth. With regard to Syme's amputation I need merely remind you that the tendency of all modern surgery is to make amputation flaps of skin, and it will be sufficient to quote the opinion of Sir William Fergusson about Syme's amputation in particular. Fergusson says: "I know of no amputation—no style or kind of amputation—which deserves more high consideration. There is everything associated with it to lead to perfection in our modern estimation of such a proceeding; a long stump, and a perfect covering to the end—a covering more perfect than that of any other stump; for the reason that the very bit of soft material on which we naturally stand, is still preserved for the future basis of this support. It is the greatest addition to amputation in modern times."

The great principle Syme enunciated with reference to *organic stricture of the urethra* (which we now know to be true) is that no stricture through which urine can pass is impermeable, and that organic stricture can be cured by what is called dilatation, and by nothing else. Dilatation, in the surgical sense of the term, consists in passing a bougie through the stricture, using a larger one every third or fourth day, till the full size is reached, and then continuing to pass full-sized instruments afterwards until the stricture is cured. The remarkable circumstance about this result is, that it is the passage of the instrument over the diseased surface which effects the cure, and not any mechanical stretching or dilating by multiple splitting. The treatment can be shortened by dividing the stricture either by internal urethrotomy, or by splitting it with a Holt's dilator; so that a full-sized bougie can be passed without delay at the first sitting. The disadvantages of internal urethrotomy are that the cutting instrument is out of the sight and of the direction of the finger of the operator, and that the cutting cannot be confined to the diseased part alone of the urethra. On the other hand, with a properly made dilator, such as this, which Messrs. Arnold of London made for me, nothing but the strictured part of the urethra is split, and it cannot injure the healthy portions of the urethra; in point of fact they are never injured or interfered with by it in any way.

The next noteworthy phase of Syme's genius, which has had a remarkable effect upon modern surgery, was his almost intuitive perception of the cardinal point or essence, not only of an obscure case of disease, but also of new procedures and propositions in surgery. When Simpson brought *chloroform* to the notice of the profession, Syme very quickly perceived the nature of its action, and laid down rules for its administration, which have been proved by clinical experience, and by the experiments of the Hyderabad Commission, to be entirely sufficient when strictly followed to ensure the safety of the patient.

Syme's rules are (and I beg you will consider them well): "The points we consider of the greatest importance in the administration of chloroform are: first, a free admixture of air with the vapor of chloroform, to ensure which a soft porous material is employed, presenting a pretty large surface, instead of a small piece of lint or any other apparatus held to the nose; secondly, if this is attended to, the more rapidly the chloroform is given, the better till the effect is produced, and hence we do not stint the quantity of the chloroform. Then, and this is the most important point of all, we are guided as to the effect, not by the circulation, but entirely by the respiration; you never see anybody here with his finger on the pulse while chloroform is given. *We never continue the inhalation beyond the point when the patient is fully under the influence of the anæsthetic.*" Finally, Syme accepted and adopted Listerism as the perfection of surgical science, in that it keeps away or removes from wounds every source of external irritation and contamination which can interfere with the natural processes of healing or cicatrisation. The Listerian principle came to Syme as the most fitting termination of his labours in surgery, and he welcomed it with the quiet satisfaction of a successful general who has taken a leading part in an arduous campaign which ends in long anticipated victory.

This brings us to the consideration of the direct influence of Sir Joseph Lister on surgery. However much the teaching of Pott, and later of Syme and his contemporaries, had led up to the antiseptic principle, or had, as it were, prepared the way for it, it came eventually as a surprise, and it revolutionised the surgery of the civilised world. The change was complete and final, though Lister has since improved his methods, as the principle has been developed and circumstances have seemed to require it. The antiseptic method of Lister shewed us exactly how to attain the very thing surgeons had been striving after for so long, but which no one had previously discovered. No surgeons had made greater efforts in this direction than the French. I spent the year 1868 studying medicine in the Paris Hospitals, first in the service of Alphonse Guerin at the St. Louis Hospital, and later in that of Maisonneuve at the Hotel Dieu. Alphonse Guerin thought he had discovered the panacea for surgical fevers and blood poisoning in lavish dressings of alcohol. He was undeceived by one of the worst outbreaks of pyæmia in the St. Louis Hospital, which it is possible to imagine—one of his patients actually died of pyæmia after the amputation of a finger. Maisonneuve worked in a different fashion. His idea was that it was impossible to keep the germs of putrefaction, whatever they might be, out of wounds, and he therefore endeavoured to prevent organic fluids from collecting in them, by exhausting them with an air-pump—which the patient had to work himself—and which was, on this account, impracticable. In other places it was hoped that by giving patients more cubic space in larger, better constructed, and better ventilated hospital wards, success would be obtained. As to the value of this plan many of you may recollect what happened here in Calcutta. The Medical College Hospital was very nearly condemned as unfit for the treatment of surgical cases on account of inveterate pyæmia and erysipelas. At one time all the surgical patients were placed in tents, but, if anything, the erysipelas and blood poisoning were worse in the tents than they had been in the wards. All other attempts to successfully stamp out septic processes in wounds failed, and there is no more to be said about them, but that they failed, because they were not Listerism. The changes brought about by the introduction of the Listerian principle were mainly two-fold: one immediate, and the other remote. The immediate change was that hospitals in every part of the world, which had previously been considered unhealthy, became healthy under the antiseptic system, and it was found possible to keep surgical wounds absolutely free from sepsis and infection, no matter in what hospitals they were treated. The remote change effected by the Listerian principle in surgery is very ably explained in Watson Cheyne's paper on "Modern Methods or Wound Treatment" in the *Lancet* of 17th November 1894. He shews that in the surgery of compound fractures and dislocation, in that of the veins, of diseased joints, of hernia, of the abdomen, thorax, and brain, of cancer, of gland disease, of gangrene, and of many other conditions too numerous to mention, a vast alteration in practice has occurred, which, from a purely surgical point of view, is entirely due to Listerism, and that the area of surgery has been enormously extended and expanded in almost every conceivable direction. Mr. Cheyne truly states that formerly amputation was performed in compound fractures, in cases where the limb is now saved with certainty. It is a mistake, however, to condemn our predecessors on account of the amputations they were mostly compelled to perform for compound fracture. In ordinary cases, in the pre-Listerian days, amputation was oftener than not the best treatment available, and many a patient lost his life owing to humane attempts to save limbs, which afterwards became the rest of fatal sepsis. I remember an experience of a singular kind which a surgeon, who was with Breckenbridge's division, underwent during the American Civil War.

A soldier was shot through the elbow joint. The surgeon advised amputation. The soldier objected and vowed that if he recovered he would shoot the surgeon who took his arm off. After a consultation the operation was performed, and the man was sent to a hospital in the rear of the army. When the war was over the surgeon was walking in New Orleans one day and met him, and instead of shooting him, the latter told him that he owed him his life. In the hospital, to which he had been sent after the amputation, he saw many soldiers with wounds like his own, in which the limb had been preserved, but they all died. He was the only one of the whole lot who recovered, and the amputation, therefore, in his opinion, saved his life.

With regard to the theory of Listerism, I do not profess to be an authority. The theory of sepsis you will doubtless accept as correct: but the theory of suppuration and of pyogenic organisms is, in my opinion, too simple on the one hand, and too far fetched on the other, to cover the whole field of surgery and inflammation that is embraced by Listerism. In Watson Cheyne's article pyogenic organisms are said to be the cause of suppurations in wounds, but I do not find a word about the inflammation which must precede it. There is no doubt that Lister has demonstrated the power of the tissues to destroy bacteria, but the citation of this fact to account for the almost invariable union by the first intention which takes place in the operation for harelip appears to me to give it undue importance. A more reasonable explanation is to be found in the impossibility of any collection or lodgment, either of fluids or of bacteria, between the surfaces of wounds, which, like those for harelip and ovariotomy, have a double exit for surplus discharges and exudation. When the wound is properly adjusted in these cases, the amount of exudation is sufficient to secure union and no more. But if one or two stitches are put in too tight, the wound inflames in the track of the sutures, and it will be lucky if union by the first intention is not prevented by the inflammation affecting the whole wound. Without attempting to reconcile opposing theories, however, we can state confidently that the Listerian principle arms the surgeon at all points in the treatment of wounds, which, for practical purposes, may be divided into three great classes. In the first class may be placed all operations, as Watson Cheyne puts it, through unbroken skin, and all traumatisms in which the avoidance of septic or ineffective complications can be prognosticated or anticipated with certainty. The precautions and dressings in wounds of this class must be carried out in strict accordance with the Listerian plan, and they then heal by the first intention, without inflammation or suppuration. All wounds in which union by the first intention without inflammation cannot be reckoned on with certainty fall into class two, which therefore embraces wounds of a doubtful nature. As regards sepsis, *i.e.*, wounds in which it is highly probable that sepsis has already commenced owing to a self-evident cause, like delay in treatment, or to an obscure cause, such as is found to be at work in many forms of abscess of the liver. Lastly, this class includes the immense variety and number of wounds where sepsis exists beforehand : the type of which is to be found in Syme's amputation of the foot for caries, with suppurating sinuses, and surfaces which cannot be excluded from the operation wound. In this very large class of wounds, antiseptic precautions and dressings are employed, but the essential factor in obtaining and maintaining a sepsis is to keep them wide open, and convert them, as far as possible, into superficial wounds, until they can be closed without risk. In abscess of the liver this is done by excising two or more ribs. In Syme's amputation for caries, the heal flap must be kept wide open until granulation is established. It may then be brought into its normal position, and union by the third intention will at once be obtained.

The third class comprises wounds, with double exits, such as those for harelip and abdominal sections in which drainage is not necessary. In abdominal sections the most rigid antiseptic precautions are necessary during the operation to prevent contamination or infection of the peritoneal cavity ; if drainage is required, these precautions have to be extended to the discharges, and Listerian dressings must be employed. But if the peritoneal cavity does not require drainage, the wound in the abdominal parietes needs no dressings. It should be treated, as we always treat it, exactly like a harelip. Antiseptic collodion should be painted over it after the sutures are applied, and once a day subsequently until they are removed ten days later. In abdominal section whatever discharge or exudation there is from the wound under these conditions tumbles into the abdominal cavity, where it is absolutely safe.

Such is very briefly the practical position of wound treatment at the present time. It is the surgeon's duty to prevent sepsis in all wounds made through unbroken skin, and to arrest it without delay in all wounds where it already exists. Whether Lawson Tait can accomplish this object by enlarging his hospitals and by what he styles the strictest possible cleanliness, or other surgeons can do it by aseptic filtration dressings, or Watson Cheyne by true antiseptic methods, it is all one and the same thing—the fulfilment of the Listerian principle. No doubt before 1866 wounds did heal, and from time to time in the future will heal, without Listerism, but this is not the point. The point is that we now know how to protect wounds from both putrefaction and infection, and to ensure their union by the first intention, almost with mathematical certainty and precision, without inflammation or suppuration; and no one can pretend that we knew how to do this before 1866, or that we owe our knowledge to anyone but Sir Joseph Lister.

It is not difficult to estimate at its true value the immense influence of the late Sir James Simpson on modern surgery. Who actually found out that there is such a chemical compound as chloroform is a matter of no consequence now. Simpson discovered its uses as an anæsthetic; it was he who established its employment on proper principles in surgery, and to him belongs the credit. I have quoted Syme's rules for the safe administration of chloroform, and Syme himself said: "I am very far from taking any credit to myself, all that I have done has been to follow the example of Dr. Simpson." The clinical value of Syme's rules is proved by the fact that those who follow them give chloroform with uniform safety all over the world, while those who do not follow them, and watch or depend upon the pulse, cannot do so. This is not my own statement; it is what those who watch the pulse themselves state, that no one can give chloroform with uniform safety, because it acts upon the heart, and that, therefore, a certain number of deaths are unavoidable. The heart theorists did not accept the clinical statistics of Syme's followers. They said "what is the use of your statistics, which simply shew so many administrations without a death, when we have deaths under chloroform every day, which we are convinced are due to direct failure of the heart;" and in 1889 they demanded that our clinical statistics should be abandoned or supported by experiments on animals with self-recording apparatus. Accordingly, in virtue of the kingly and wise liberality of the Nizam, the Hyderabad Commission was appointed, on my suggestion, to determine once for all whether Syme's rules are right or wrong. The Commission proved that chloroform causes death by stoppage of the respiration and not by stoppage of the heart. One of the few points on which the Commission did not furnish any explanation was with reference to what occurs after the breathing stops; and it was for a long time supposed that asphyxia supervened, on failure of the respiration, and was the cause of death. This idea was shown to be wrong by Victor Horsley's experiments on the mode of death in bullet wound of the brain. Formerly it was believed that when a bullet is fired through the cerebrum, instantaneous death takes place from stoppage of the heart. Victor Horsley demonstrated that this is not the case; that death is caused by hydro-dynamic pressure on the respiratory centre and sudden complete arrest of the respiration. The mode of death is on all fours, to use Mr. Horsley's own expression, with death from chloroform, and one tracing serves to illustrate both. The respiration stops—suddenly in bullet-wound of the brain, gradually, as a rule, in overdosing with chloroform—and there is no asphyxia. The heart being deprived of its nutrition runs down and stops, and so complete is the resemblance between the two that if no time is lost the breathing may be restored, in bullet-wound of the brain, just as it may be in overdosing with chloroform, by artificial respiration.

The Hyderabad Commission not only proved that Simpson and Syme were right, but it rid modern surgery of the bugbear of direct failure of the heart under chloroform, and of chloroform syncope; and it is just as irrational to stick to it and to bring forward cases to prove that death from chloroform is due to direct heart failure, as it would be, in the face of Horsley's experiments, to assert that death from bullet wounds of the brain is due to syncope and not to stoppage of respiration. It is true that the Hyderabad Commission's experiments were performed in India, but, if it is necessary to apologise for this matter of fact, it is enough to remind you that they could not possibly have been performed in sufficient number to satisfy Lauder Brunton anywhere else, and the effects of chloroform, no less than of bullet wound of the brain, are precisely the same in India as they are in Europe.

Another point which was left undetermined by the Hyderabad Commission, but which is more of physiological than of clinical and practical importance, is the question of the exact and immediate cause of the fall of blood pressure that occurs in all forms of anæsthesia produced by chloroform, or by ether, or by gas, or by asphyxia. To elucidate this, Professor Gaskell was asked to make further experiments, for which the expenses were again generously met by the Nizam's Government. As the result of a series of very ingenious but complicated experiments, Gaskell has been led to contend that the fall of blood pressure is actually the result of the action of the chloroform on the heart tissues, though, at the same time, he believes there is practically no danger to the heart in the administration of chloroform, and agrees with the Hyderabad Commission that the supposed occurrence of direct cardiac syncope is a myth. It is unfortunate that this opinion of Gaskell's, qualified as it is, should be taken as a reason for believing that chloroform is dangerous to the heart, although such danger is repudiated by Gaskell himself, who should certainly be the best judge of the limits of the peculiar action upon the heart in which he believes. Moreover, a fall of blood pressure is inseparable from all forms of anæsthesia at present known to us, and, consequently, if we are to give up chloroform, because it causes a fall of the blood pressure, we must also give up ether, nitrus oxide gas, and every other form of anæsthetic. There is no necessity then, nor is this the place to discuss the reasonableness or otherwise of Gaskell's peculiar views.

I have only one further remark to make about the Hyderabad Commission, and I make it with an amount of pleasure which I shall not attempt to disguise. The success of the Commission's experiments was entirely due to Dr. Bomford. It was he who recorded on the tracings of the manometer every fact as it occurred. If you examine the specimen tracing sent round, you will see what perfect work this was and what a toil it must have been to carry out. But this is not all. Many physiological facts were brought out by the Commission's research, for which Dr. Bomford has never received the credit to which he is justly entitled. He discovered that the fall of blood pressure, which is produced by the direct action of chloroform, is not, as was previously supposed, dangerous; and that asphyxia does not raise but always lowers the general blood pressure. Lastly, Dr. Bomford made it clear that the action of the vagus under chloroform, which up to 1889 had been universally regarded as a source of peril, is a safeguard; and this led to the remarkable and beautiful discovery that inhibition of the heart by the vagus can never do it anything but good, and that it is paralysis, and not stimulation of the nerve, which is dangerous, and leaves the heart defenceless and a prey to injurious influences.

Finally, as you all know, the acknowledged safety of chloroform in India has been accounted for in various ways by our brethren in England. It does not appear to have struck them that the real reason for the safety of chloroform in this country is that the principles of Simpson and Syme have for many years past predominated, and it is not too much to state the general adoption of these principles in modern surgery in future will alone render the benefits of Simpson's priceless discovery unlimited.

Gentlemen,—I have finished. I have endeavoured to bring before you this morning some of the principles of surgery which have been handed down to us by men like Pott and Syme. Their greatness and success as surgeons lay largely in their profound knowledge of anatomy, their choice of simple procedures and methods of operation, and their undivided responsibility for every thing connected with the treatment of their patients. We cannot—every one of us—be a Syme or a Treves—the beau ideal of a modern surgeon—but we can all follow great principles and noble examples; and of one thing I am quite certain—India can and will produce her full share of great men in our beloved profession.

VOTE OF THANKS TO PRESIDENTIAL ADDRESS.

Dr. Reid (Aberdeen) said: Ladies and Gentlemen,—It gives me very great pleasure to ask you to accord a very hearty vote of thanks to Surgeon-Lieutenant-Colonel Lawrie for the exceedingly interesting and instructive address to which we have listened.

I am sure that you will agree with me, when I say that Dr. Lawrie was unduly modest in his opening remarks, for the name of Lawrie is, if I may so put it, a household word, in the anatomical, physiological and surgical world, not only in India, but also in the mother-country.

I feel certain that the words which we have just heard will be eagerly read, and will form a vast fund of instruction, not only to our colleagues throughout Her Majesty's dominions, but also to those of other countries. I, therefore, formally move that a vote of thanks be accorded by this section to its President, Surgeon-Lieutenant-Colonel Lawrie, for his introductory address.

The vote of thanks having been seconded by Lal Madhub Mukerjee, Rai Bahadur, was carried unanimously.

A RETROSPECT OF OPHTHALMOLOGY IN BENGAL.

BY LAL MADHUB MOOKERJEE, RAI BAHADUR, L.M.S., F.C.S.

Ophthalmology as an exact and accurate science is as modern as bacteriology. As a crude art, it is as ancient in Oriental literature as the Hindu Sastras. Away back in the Dark Ages, Asiatic practitioners of medicine recognised and wrote about and dogmatised on the treatment of most of the disorders of the eye that are known to ophthalmic surgeons of recent date.

With the invention of the ophthalmoscope a new era dawned upon the domain of ocular pathology and therapeutics, and with this scientific achievement have come all those advances in Western ophthalmic science and practice that give it so high a place when compared with the art as it is found in the teachings and practices of Orientals. There must always be given a recognised value to the advantages which Western ophthalmologists had over Orientals in their knowledge of ocular diseases and their treatment. From the teachings of anatomy and physiology with the West, there was an intimate knowledge of the structures and tissues of the organs of vision, their special functions and changes from health to disease, which were rendered easy and manageable by the light of sound pathology and morbid anatomy. These were all advantages which placed the West on a much higher platform than the East. Yet the fact remains to the credit of Oriental ophthalmic art that, shorn of all these helpful scientific auxiliaries, our ancestors in medicine in Bengal and throughout Asia successfully combated nearly all the best known disorders of the human eye. Such diseases as conjunctivitis, iritis, keratitis, ulceration of the cornea, non-specific and specific ophthalmia, granular lids, ectropion and entropion, cataract in its various forms, the causes of faulty vision and blindness, were all treated systematically and very successfully.

It must be admitted, however, that while Oriental medical literature had its place in the archives of the learned, the flood-gates of knowledge were closed to all but a select few, and the bulk of Oriental practitioners were illiterate so far as book-learning went, and their practical knowledge, which was often exceptionally good, was gained by a species of discipleship and governed by the teachings of tradition rather than any written precepts.

With this preamble I come to the era which marks the dawn of Western light and education, not only in the province of Bengal, but throughout British India. My remarks, therefore, whilst they tend to portray the state of ophthalmic science in Bengal, have an intimate relation to the history and spread of this important branch of Western medicine throughout India; for Bengal was the starting point of the introduction of Western education in every science and art, as they are found throughout the Indian Empire of to-day.

The history of modern ophthalmics in India dates from the establishment of the Medical College in Bengal in the year 1835. Prior to this a number of Surgeons of the old Honorable East India Company's service had opened dispensaries in various stations in Bengal, notably in Calcutta, where the poor had their ailments gratuitously treated and often at the entire cost of these doctors.

In these out-door infirmaries, as they were called, there were a few beds for operation cases, and here Western medicine gained many of its earliest disciples, who became useful and distinguished practitioners. Not however till 1835, that is the opening of the Medical College and Hospital in Calcutta, was any well organised effort made to teach anatomy and physiology. Sixteen years later Western ophthalmics found an able exponent in Dr. Martin, whose appointment to the chair of ophthalmic medicine and surgery dates from the year 1851.

His successors, Drs. Archer, Macnamara, Cayley and Jones, have all been men of great ability, and have left brilliant legacies of their work behind them. Charles Macnamara, who is now one of the leading ophthalmic surgeons of London, gave India the first work of eye surgery and medicine based on Indian experience, and this book is still a valuable guide to our students, in spite of the gigantic strides that ocular therapeutics has made in the past two decades. I will deal briefly with some special points connected with ophthalmics in Bengal, and of necessity I can only touch the merest fringe of my subject, which has admittedly a very wide range. The world has been busy with ophthalmics, and never in the history of our profession has there been such a profuse display of knowledge and original research in ocular therapeutics as we have seen in Great Britain, America, France, Germany, and Europe generally at the present time. It is not my province to deal with new light and recent knowledge, but I am called on to sift the garnered grain of past generations, and to present, if possible, in a nutshell the work of others, whose lives and records are now matters of history. In Bengal we have ocular diseases common to India generally, but I am concerned only with this province, and the limit of time and space remind me, and you also, of the duty of brevity. My remarks therefore will scan such familiar disorders as cataract, ophthalmia, neonatorum, glaucoma, atrophy of the disc, and disorders of refraction and accommodation

Cataract.—The occurrence of cataract in Bengal is very common, and this may be judged by the fact that on an average nearly three-hundred operations have been performed yearly in the Eye Hospital of the Medical College during the past thirty years.

The most generally performed and most successful method of operating for cataract in Bengal has been and is still by simple extraction of the lens without iridectomy, the pupil being previously dilated with atropine. The incision involves about one-third of the cornea, and is made as nearly as possible in the sclero-corneal junction. There is much in success which depends on the individuality of the operator, and this cannot be exaggerated. Clean steady fingers and a delicate dexterous touch, with a high moral appreciation of the responsibility, do more to make a record in successful ophthalmics than all the book reading in the world. I am able to corroborate this assertion by my own experience in watching the exceptionally able and dexterous operative work of my old teacher and friend Dr. Charles Macnamara, a former professor of ophthalmics in the Calcutta Medical College Hospital. His modified linear extraction, which bears his name, involved no iridectomy. The pupil having been previously well dilated his incision so perfectly performed by a special knife of his own invention, left it an easy matter to introduce a scoop, and with a gentle pressure exerted upon the circumference of the lens, caused it to be rotated on its axis to find a rest in the concavity of the scoop, and thus delivered from the eye with the least possible disturbance of the adjoining structures. The lens with its capsule entire being so freed there resulted the most perfect success of vision possible.

Such too was the special individuality of Professor Henry Cayley of our College, whose operative work with cataract was extremely successful from the combined methods of Professor Macnamara and Von Graefe. The success of these two Calcutta ophthalmic surgeons gave a result of eighty-seven per cent of cures by Macnamara's method and seventy-seven per cent by Von Graefe's. It is important in this connection to state that these results were from hospital patients, in whom there was no choice of selecting suitable or unsuitable cases. The records of these surgeons in private practice, where selection was the rule, yielded far better results, and a success of ninety to ninety-five per cent was nearer their average. Personally my experience during a practice of nearly thirty years, which has been guided largely by my association in work at the Ophthalmic Hospital for fourteen years with Drs. Macnamara, Cayley and Jones, has led me into selecting the operation for cataract usually performed by these surgeons, combined and modified, that is, A. Von Graefe, the section being however purely corneal, and thus avoiding iridectomy in every possible case; and I may with gratification say that I have had results that equal those of my revered teachers.

The operation which I have been accustomed to perform for many years past is preceded by preliminary antiseptic precautions. I wash my face and hands and then cleanse the face, eyes and eye-brows of the patient with cotton and a solution of boracic acid (one grain to an ounce of water), the lotion being freely put into both eyes while the patient is in bed. I now drop a freshly prepared 3 per cent solution of cocaine into the eye to be operated on, which has already for two or three days been under the influence of atropine. The instruments are dipped in boracic lotion and then used. Special attention is paid to the knife which is tested before operation as regards sharpness and polish. I use a stop speculum. The section made by a Graefe's knife is corneal, and occupies nearly the upper third of the cornea. The left hand is used for the left eye, and the right for the right. The section is completed by cutting directly through the cornea. It is so cut through that it allows the edges of the section to come directly together. I then take the curette and place it on the sclerotic at the lower part near the cornea sclerotic junction and deliver the lens by pressure. I allow a little time to elapse if necessary for accumulation of aquous to reveal any lenticular substance which may remain behind. The iris invariably gets into its place; if not, I set it by gentle manipulation or by allowing the rays of light to act on it. Sometimes it may be that I have to take the aid of the curette to adjust the section and to replace the iris. I then drop in a 4 grain solution of atropine to put the iris at rest, and apply a pad and bandage to both eyes.

I perform iridectomy, if the pupil has not responded sufficiently to atropine, or if the lens is hard and large, or if there is adhesion of the pupil; where the lens requires to be removed by a vectis or a curette, or if by accident the iris be injured, and when the patient is incapable of enduring the quiet indispensable to the prevention of prolapse of the iris.

Concerning loss of vitreous in cataract operations.— This accident was held for many years by operators in Great Britain and on the Continent as a calamity involving insecurity to after vision in cataract operations. It is a remarkable fact that Dr. Charles Macnamara held and taught as far back as 1868 that loss of *one-fourth* of the vitreous was no bar to a perfect recovery of sight. His declaration on this matter was stoutly contested in London, but time has proved that Macnamara was right, and now our friends in Europe are reconciled to his views.

In 1880 I recorded the following statistics on loss of vitreous, which were read in my paper on this subject before the Calcutta Medical Society.

From the records of 926 cataract operations in the Calcutta Ophthalmic Hospital I have found there was loss of vitreous in 122 cases, in which the methods of operation followed were :—

1st.—Upper section with iridectomy without laceration of the capsule in 99 cases.

2nd.—Macnamara's operation in 21 cases.

3rd.—Lower section with iridectomy and laceration of capsule in 2 cases.

In these 122 cases, 89 recovered good vision and 5 fair vision and 28 cases failed.

The causes of failure were: 10 by iritis and 9 by atrophy of eye ball, 8 corneal sloughing, and 4 panophthalmitis. In 5 of the 28 unsuccessful cases the vitreous loss was very large, and in the remaining 23 less than a fourth of this fluid escaped.

With regard to the quantity of vitreous lost in the 122 cases, in 9 there was slight oozing, in 91 the loss was less than a fourth, and in 22 more than a fourth, amounting to almost complete escape of the humour.

It will be evident that where vitreous was lost, the quantity had very little to do with the result of the operation, for where the largest quantity was lost as in the above mentioned 22 cases, 17 were cured and 5 only were unsuccessful, so that the percentage of success was 77.

In the cases where the loss was less than a fourth, as well as those in which vitreous only slightly oozed out, 72 were successful and 5 partially so.

Of the 926 cases, 737 were quite successful. In 34 cases sight was restored partially, and in 155 cases the result was unsuccessful, or there were 84 per cent of cures. But it has already been shewn that the percentage of cures in cases where the vitreous was lost was 77 or a difference of 7 per cent.

Out of the 926 cases, 113 were soft cataract, and in them there was no loss of vitreous.

From my experience I have found that loss of vitreous as a complication generally occurs in operating upon the second eye when the first eye has been spoiled by maltreatment by *mals* or quacks.

There is a remarkable augmentation of cures in recent times due probably to a more extended knowledge, the selection of operations, and to antiseptics.

But there is a regrettable drawback that every ophthalmic surgeon in Bengal has to contend with, that is, the need of a practical surgical instrument-maker to sharpen cataract knives, as all instruments have to be sent to England for repair. Reverting to the subject of augmented success in cataract operations, the recent experiences of the Calcutta Medical College Hospital, in which undoubtedly individuality as a feature conducing to success has played an important part together with modern antiseptics, we find the report of the Eye Hospital of Calcutta with a percentage of cures that has reached the high figure of 95·56 per cent, but 76·13 has been the average for the past six years. Surely, this is an achievement which reflects considerable credit on Professor R. C. Sanders, our present ophthalmic surgeon.

In recent times the prevalence of diabetes in Bengal has added largely to the occurrence of cataract, and it is remarkable that these patients derive considerable benefit from a judiciously performed cataract operation. The later stages of diabetes which usually terminate in nephritic changes afford abundant evidence of the great value of the ophthalmoscope as a diagnostic agent of nephritic retinitis.

Ophthalmia-Neonatorum.—Bengal is the land of mendicants. It is no exaggeration to say that a million or more of the people of this rich and fertile province are beggars. This fact is of enormous significance and interest, when it is found that over sixty per cent. of these helplessly poor fellow creatures are totally blind, and further that over forty per cent. of these visionless orbits owe their destruction to ophthalmia-neonatorum.

Total disregard of the simplest hygienic laws in the lying-in room, the absolutely careless neglect of cleanliness of the infant immediately after its birth, are ruefully responsible for more than half the blindness one sees in Bengal. Household therapeutics limit the treatment of sore-eyes in infants to pencilling the eyelids with black sulphide of antimony, or with butter and lamp black (kajul), or washing them with milk and warm water, or *neem* infusion, and these ablutions are so faultily done as to allow the lids to ensack quantities of purulent matter and thus the destructive and corrosive changes of the corneal structures go on, till vision is hopelessly ruined. If only our dhais or native midwives could be trained sufficiently to regard the vaginal discharges as peculiarly prone to infect the eyes of their infant charges, how much the number of Indian mendicancy could be reduced, and how much of happiness could be added to the blighted lives of our fellow-creatures. For the treatment of ophthalmia neonatorum I have found the early application of a two per cent solution of nitrate of silver as eye-drops most beneficial. Of course it is an eminently preventible disease, and if sufficient cleanliness be observed in washing out the vagina before birth, and in seeing to the eyes immediately after birth, it can with certainty be shorn of its ill effects. As soon as the head of the child is born both eyes should be wiped with cotton wool before they are opened, to prevent infection by any discharge which may be present, and the nurse should be instructed, when washing the child for the first time, to use different water for the eyes with a pledget of cotton wool. When this has been done, one drop of a two per cent solution of nitrate of silver should be dropped inside each of the eyes. Of course, while cleanliness is absolutely necessary in every case, it is only essential to guard the eyes of the infant by nitrate of silver solution as a collyrium in those cases in which there is a suspicion of impure vaginal discharges. Frequent cleansing of the eyes is a *sine qua non* of treatment, and while antiseptic solutions of such reagents, as boracic acid, perchloride of mercury, permanganate of potash, &c., play a helpful part as aids, the destruction of the morbid germs, which created the disease, is most effectually performed by nitrate of silver.

Granular conjunctivitis—Is a very common affection amongst the poor, consisting as it does of the formation of granular trachomatous bodies in the conjunctival connective tissue. I have found it extremely prevalent in Bengal. It is undoubtedly due to malhygienic conditions of life. Among the various forms of treatment I have found nothing to equal dusting the lids with tannic acid both morning and evening, then once a day, and later on every other day. In the meantime keep the eyes scrupulously clean by the frequent application of antiseptic drops such as boracic acid and perchloride of mercury. Tannic acid sets up sufficient inflammatory changes to cause absorption of the neoplastic bodies. Sulphate of copper was much used in former days. We still apply the *lapis divinis* to granular lids. But I think tannic acid can better reliably take its place.

The various reputed specifics of a decade ago, such as acetate of lead, quinine dusting, solution of perchloride of mercury, and strong solution of nitrate of silver, have all had their day; but sanitary measures, general tonics, and tannic acid dusting hold the highest place in affording relief and cure to this troublesome and painful disorder.

Glaucoma.—Glaucoma is another commonly prevalent disorder in Bengal. Iridectomy is the sheet-anchor of cure of this most dreadful affection. In Bengal much difficulty is experienced in inducing sufferers from glaucoma to undergo the necessary surgical operation of iridectomy, and so recourse has long been had to various other forms of relieving intra-ocular tension by means of leeching and by ordinary antiphlogistics, but more recently the discovery of the great therapeutic value of eserine has placed in the hands of Indian practitioners a most accommodating and efficient aid. The use of eserine affords relief for some time, and by and bye the patient makes up his mind for an iridectomy. In many cases a fair field of vision is maintained by the use of eserine, while the further progress of the disease is cut short.

Atrophy of the disc.—In this common ailment, the use of eserine collyria, and the subcutaneous injections of strychnine, have afforded the best results. It is remarkable how prevalent this disorder is among excessive tobacco-smokers and in those who use gunja and alcohol.

Disorders of Refraction and Accommodation.—The rigorous enactments of the Bengal Educational Code and the high mental tension which arises out of the keen competition that marks the training and education of our youths of to-day, have resulted in a most deplorable augmentation of the errors of refraction and accommodation, and so we find boys and girls of twelve to sixteen years decorated with spectacles—a sight that would horrify our forefathers were they to return to their mundane sphere.

In past times Hindu and Mahomedan ophthalmic practitioners had to face the amelioration of a very small number of cases of disorders of refraction and accommodation, and they devised pebbles of sorts to meet these defects. But these huge and unsightly glasses of our Indian ancestors in ophthalmic medicine have given place to the delicate and well made spectacles of modern opticians. So necessary has become a knowledge of sight-testing that every general practitioner must equip himself with the means of aiding his patients and affording them relief to many insidious neuralgic manifestations which owe their origin to defective vision, or to errors of refraction and accommodation. My remarks both in their scope and measure have of necessity been limited and brief, and for this I offer my regrets. Much that might have absorbed my attention in the wide range of ocular therapeutics remains untouched, but I venture to hope my feeble efforts may incite and encourage others to lay their views and their special knowledge of ophthalmology in India before the profession through our medical journals.

In conclusion, may I plead for a more systematic and thorough training of students in our Indian colleges in eye diseases? The tendency at present is to make expert opticians but poor oculists. The prevalent idea is that a good cataract operator is a good ophthalmologist. There is nothing more fallacious and nothing more hurtful as an impediment to the advancement of truly scientific ophthalmology. We need our students to be something more than rule-of-thumb prescribers of spectacles or gougers of cataract. They must keep in touch with the ever-enlarging field of ocular pathology and therapeutices, and be well grounded in the allied sciences of medicine.

The specialism of ophthalmics is a paramount necessity, but it exists as an aid, and should be a guide to the general practice of medicine in those reflex pathological changes of which the eye is so unerring an index and the ophthalmoscope so true and faithful a guide.

No man should set up as an ophthalmologist unless experience and special education give him the stamp of honest fitness for such an onerous assumption. The specialist is the busy physician's most valuable assistant; he provides him with skilled hands, educated eyes, and trained ears, to do and see and hear that which he cannot undertake to do.

For ophthalmics our colleges have all the facilities so far as materials to teach with, subjects to practice, or students to teach are concerned, but the time allowed for teaching this important science and art is in most Indian colleges extremely inadequate. In speaking of materials, I mean patients, not apparatus. There is a marked lack of scientific appliances for the teaching of ophthalmics in all our Indian colleges, and the course of lectures, both theoretical and practical, are insufficient.

Let me express the hope that a new era will soon dawn on our country, and may this be hastened by the unselfish and generous aid of every medical official in India, who will thus gain the gratitude of a nation that owes all her advancement in modern medical science to England and to England's sons.

CATARACT OPERATIONS.

BY G. H. D. GIMLETTE,
Surgeon-Major, I. M. S.

It is not my intention in the present paper to offer you a complete treatise on the operation for cataract, and by doing so weary you with a repetition of facts with which all surgeons are familiar. I propose merely to set before you the points on which operators differ, the variations in their methods of operating, and the reasons they give for their diversities of opinion. This I shall endeavour to do as briefly as possible, adding only the conclusion to which the experience of my own practice has led me.

The operation for extraction of the lens has, since its introduction more than one hundred and fifty years ago, gone through a long series of changes; various methods have become fashionable and have again fallen into disuse. Questions as to the best position and extent of the incision, the necessity for iridectomy, the treatment of the capsule, with others of minor importance, have been debated at length for many years, and are still being debated.

To so great an extent has the operation been influenced by that great revolution in surgery,—the introduction of the antiseptic system,—that even the old flap operation of Daviel, abandoned on account of its too frequently disastrous results, has again become possible, and a precisely similar method is now followed by several American surgeons.

This operation, however, may be dismissed with few words. Free though it now is or should be from the risk of suppuration, its other defects remain. The tendency to extensive prolapse of the iris, together with the liability to displacement of the large semi-lunar flap and consequent interference with union, leave it few defenders.

Coming next in chronological order, what is known as the combined operation may now be considered. Known by the name of its great elaborator, Von Græfe, for many years its supremacy remained undisputed, and the majority of operators still practise it in some modified form.

The two main features of this method had distinct aims. The incision approaching as nearly as possible to a meridian of the ocular globe was designed to promote a more perfect co-aptation of the wound than had been previously obtained. That it does so is beyond dispute, and modifications of the original linear incision will doubtless be always practised by most ophthalmic surgeons. To Von Græfe's incision, however, there are many objections. It is unnecessarily extended. Encroaching as it does on the sclerotic, it renders the ciliary region liable to injury. With an incision so far removed from the centre of the eye, occasional bad presentations of the lens are inevitable; and the complete removal of all the cortical substance is often a matter of very great difficulty.

These drawbacks soon led to alterations, many surgeons making their puncture and counter-puncture nearer to, or actually in, the cornea, and terminating their incision either at the sclero-corneal junction, or in the cornea itself. Several of these varieties have been minutely described by their supporters and their advantages insisted upon, the balance of opinion seeming to be now in favour of an incision just inside the corneal limit, and corresponding in extent to one-third of its margin.

An entirely corneal incision was formerly supposed to be much more liable to infection. This objection, of course, has no longer any weight, and, on the other hand, the advantages are many. It causes no hæmorrhage, the extraction of the lens without iridectomy becomes possible, there is less chance of prolapse, soft cortical matter escapes more freely, and the ciliary region is avoided. Obviously, however, the incision must be large enough to let the cataract out easily, and in case of a very large lens, the sclero-corneal margin must be included or even crossed. A corneal incision is, moreover, more difficult than Von Græfe's, a certain knack being necessary to avoid an irregular wound of the iris in completing it. Many distinguished German surgeons have preferred, and still prefer, a downward corneal incision. It is perhaps easier than an upward one, and fixation is not so indispensable. The objections to it, however, are sufficient to prevent its being generally adopted. If an iridectomy should become necessary, an inferior coloboma is the result, and, as a rule, the lips of the wound do not come together so neatly as when the opposite direction is taken.

A downward incision without iridectomy was always practised by Liebreich and those who were his pupils, or may have attended his clinic, some twenty years ago, must well remember the brilliancy with which this distinguished surgeon operated. Without anæsthetic, assistant, or fixation, he held in his clever fingers a single instrument, having at one end of it a Von Græfe's knife, and at the other a curette and a cystotome. The power which he exhibited of keeping his patients still by quietly talking to them until their condition resembled hypnotism was extraordinary. During the progress of a quaint monologue, the lens was extracted with marvellous certainty and rapidity. I witnessed very many of his operations, and never saw an accident or immediate complication.

We come next to the second feature of the combined operation, over which the hottest controversy has been and is maintained, ophthalmic surgeons having arrayed themselves into two parties, the non-iridectomists and the iridectomists, the former accusing their opponents of needless mutilation, and being accused in turn of unjustifiably sacrificing a certain percentage of eyes for the sake of mere appearance. On the whole, the militant iridectomists appear the less reasonable, insisting on the universal application of their method to all cases, while the non-iridectomists admit that a selection must be made.

The excision of a portion of the iris was originally introduced, not so much to afford more room for the exit of the lens, though its adoption was coincident with that of a comparatively small incision, as to obviate the chances of prolapse and the danger of bruising the iris by forcing a hard lens through the pupil. With Von Græfe's incision, an iridectomy was *a sine quâ non*; its peripheral situation would otherwise have rendered prolapse almost inevitable. When a corneal incision is made, however, there is far less danger of this, and experience has shown that an average sized lens may pass through the pupil without any material damage to the iris.

Examining the relative advantages and disadvantages of the operation without iridectomy, we find that its advocates claim for it—

(1.) Rapidity and simplicity.
(2.) The preservation of the natural appearance of the eye.
(3.) Greater acuity of vision.
(4.) Less danger of loss of vitreous, the intact iris keeping it in place.
(5.) The absence of hæmorrhage, often so troublesome when the iris is cut by obscuring the field of operation and concealing the lens.
(6.) The absence of the pain which accompanies iridectomy, with its attendant risk of a sudden movement on the part of the patient.

(7.) Less tendency to the entanglement of portions of capsule in the lips of the wound.
(8.) The absence of any entanglement of tags of iris in the corners of the wound, which often occurs when a small iridectomy is done.
(9.) Less chance of the necessity for secondary operations.

The arguments on the other side are—

(1.) That the operation, though quicker, is more difficult.
(2.) That the section must be larger, and that its necessary situation causes a risk of the iris being unintentionally cut by the knife.
(3.) That the clearing of the pupil is more difficult, an iridectomy affording an easier exit.
(4.) That the iris may be severely bruised by the passage of the lens through the pupil.
(5.) That there is a great risk of a large prolapse of the iris.

As regards acuity of vision, a very large number of most careful examinations and comparisons have been made by Gayet and several other surgeons with the object of settling this point at rest. They prove that there is absolutely no difference at all in the result, whether the simple or the combined operation be done.

The sole advantage then of a central and moveable pupil after extraction of the lens seems to be that of symmetry, and even this is no great gain ; for the coloboma left after a small upper iridectomy is entirely concealed by the upper lid, which must be lifted to discover the deformity in an old patient.

Iridectomists also reply that hæmorrhage may be checked by cold and staunching. Some of them adopt the expedient of opening the capsule before the iridectomy. To this plan, however, there is the grave objection that any movement of the patient caused by pain would in such case be much more dangerous than if the capsule had remained intact. Entanglement of the capsule may be prevented by a transverse laceration or by capsulotomy, and the entanglement of tags of iris remedied by a careful "toilet." On the whole, it may be concluded that iridectomy is indispensable in certain cases, namely, if synechia be present; if the patient cannot be kept perfectly quiet; if the lens do not present easily and readily; if the iris do not fall back well into its place, or if it shows a tendency to prolapse; also after the extraction, if there has been difficulty in forcing the lens through the pupil, and consequently bruising of the iris; or if cortical matter hang about the edge of the pupil or lurk behind the iris.

There is a general impression that the safest method of all is that which includes a preliminary iridectomy, and undoubtedly there is less danger of losing an eye if one has a coloboma all ready made. It is not, however, generally practicable. A long time elapses before the patient recovers his vision. He is not always willing to submit to two operations, and the two incisions cause a greater amount of subsequent astigmatism. A preliminary iridectomy has in certain cases another good effect, that of hastening the maturation of the lens. Other methods with the same object are occasionally adopted. They have been enumerated by Landolt as (1) puncture of the lens ; (2) puncture preceded by iridectomy; (3) rupture or excision of portion of the capsule without puncture of the lens ; (4) massage of the lens, either from without, or directly by means of a spatula ; (5) puncture and massage combined ; (6) such massage as is obtained by simple tapping of the anterior chamber, the lens being brought into contact with the back of the cornea. Many of these proceedings involve considerable risk; iritis and glaucoma not uncommonly follow; and the interests of the patient should call very loudly for haste before any attempt at artificial maturation can be considered justifiable.

Another point of difference among surgeons is concerning the treatment of the capsule, some making a passage for the lens by excising a portion of the anterior capsule with specially devised scissors, which are, however, much more difficult to use than is a cystotome. This procedure is said to be of great advantage in cases of opaque capsule, and in hypermature cataracts with thickened centres.

There is, however, another question about the capsule, namely, is it invariably necessary to open it at all? Some distinguished surgeons, among them Pagenstecker and Macnamara, do not do so ; and it seems certain that in cases of hypermature and Morgagnian cataracts (much more common in this country among hospital patients than in England) rupture of the capsule may be omitted without any additional risk. In old people, moreover, the suspensory ligament is weak and easily gives way, only slight pressure being necessary very often to extrude the lens with its capsule intact. The advantages of accomplishing this and leaving a perfectly clear pupil are, of course, very tempting ; and, with proper judgment in the selection of cases, the accident of an extensive loss of vitreous —the danger to be avoided—should seldom happen. It is to be remembered, however, that the very greatest care and a light touch are absolutely indispensable.

Finally, some differences in the after treatment of cataract have to be considered. Most American surgeons now-a-days put little restraint upon their patients, do not keep them in bed, and close only one eye. The majority of operators, however, still insist on rest and covering. Complete immobility can hardly be secured when the patient is walking about and using a sound eye ; and as regards practice in this country, dealing as we do with so large a proportion of unintelligent persons, often very difficult to manage, it seems wiser to stick to the old plan of absolute rest in bed for at last four days, with pads and a bandage over both eyes.

Looking over the notes of between five and six-hundred of my own cases, I find that the most successful have been those in which I found it possible to extract the lens in its capsule and without an iridectomy. In 118 of such cases only three eyes were lost. The next best lot of cases are those in which I was able to extract the lens in its capsule after an iridectomy ; out of 91 of these only three eyes were lost.

On the other hand, I have had bad results from operations in which the capsule was ruptured, but no iridectomy performed. This method I have definitely abandoned. It is obvious at first sight in many cases that the capsule will have to opened. In these I commence with a small iridectomy. In other cases, unless a gentle attempt to press out the lens capsule and all through the pupil is at once successful, I do the same, proceeding then to extract the lens either with or without its capsule, as circumstances dictate. My incision is always corneal with a shallow flap.

The prevalence of cataract among natives of this country, the very large number of extractions annually performed by surgeons in India, and the high degree of skill attained by so many of them must have led numbers of the profession to expect at this Congress many valuable and authoritative opinions on a subject, which is of considerable interest to a large proportion. I trust that these opinions will now be heard, and that they will tend to the settlement of some, at least, of the moot points. Many minor differences in technique must always remain, as in other branches of surgery. The disposition of an operator must often influence him in his choice of procedure, one man thinking that rapidity and simplicity counterbalance a possible slight increase in risk, while another more cautious sees greater safety in a longer and more elaborate method, liable though it may be to certain dangers of its own.

No one, however, should lay down any unyielding rule for himself. The operation must be adapted to the individual case, and on the judgment and common sense of the operator in deciding what to do will depend in a large measure his degree of success.

REMARKS ON LINEAR EXTRACTION OF THE LENS.

BY C. J. BAMBER,
Surgeon-Major, I. M. S.

My reasons for taking up some of your time to-day is to show what benefit I have found may be derived by using strong antiseptics, or what some would call strong, in operating on the eye for cataract in preventing suppuration afterwards. Others here present may have found other and better ways of preventing suppuration and will mention them, and in this way my having brought up the subject will be of use. Two years ago, on several occasions, eyes which had been operated upon successfully, suppurated afterwards, although the instruments were apparently thoroughly clean, and a solution of corrosive sublimate of 1 in 5,000 was used to wash the eye.

This led me to use a solution of 1 in 2,000 instead, and dust the eye after the operation with very finely powdered iodoform and boracic acid in equal parts. No irritation lasting for more than a few minutes resulted. All instruments were dipped in the 1 in 2,000 solution before use. The eye was dressed daily in this way. Since doing this no case of suppuration has occurred. Several of the cases have been suffering from chronic granular ophthalmia at the time.

This year I have had careful notes made of each of 210 cases operated upon by me. These have not been picked cases, and some of them cases which were only operated upon at the earnest request of the patients and their friends. In none of these cases has atropine been used and iridectomy has only been done in a few cases.

Linear Extraction—Remarks on 210 Cases, 1894.

Name of Operator.	Linear Extraction with Capsule.			Linear Extraction without Capsule.	With Iridectomy.	Without Iridectomy.	Accidents during Operation.						Accidents after Operation.						Result.			Age.										Congenital cases and their ages.			
Dr. Bamber.	24						Slight escape of Vitreous.				Hæmorrhage in the anterior chamber.	Dislocation of lens.	Iritis.	Suppuration of eye.	Prolapse of Iris.	Escape of Vitreous.	Hæmorrhage in the eye.	Some lens matter which was eventually absorbed under the influence of *Blue pill.*	Good Vision.	Partial Vision.	No Vision.	6 Years.	10 Years.	20 Years.	25 Years.	40 Years to 45.	50 Years.	55 Years.	60 Years	70 Years.	80 Years.	6 Years.	10 Years.	16 Years.	21 Years.
	Good Vision.	Partial Vision.	No Vision.				25																												
							Good vision.	Partial vision.	No vision.	Not known.																									
210	21	1	2	186	29	181	21	2	1	1	2 A case of hæmorrhage diathesis.	1	7	Nil.	9	2	2	20	191 or 90·95 p.c. with partial v.=96·19 p.c.	11*	8†	0	4	6	3	41	67	8	63	11	1	3 not cured.	2 cured.	2 both cured.	1 cured.

* A case with lens dislocated by a Jogi is included in these cases.
† Includes one case in which the operation was undertaken owing to the earnest request of the patient.
Includes a congenital cataract, patient aged 6, operation under chloroform.
Some of the cases of partial vision would improve in time as lens matter was absorbed.

In cases in which lens matter remained behind the scoop was freely used to remove it. Extraction of the lens in its capsule has been done in 24 cases, when the eye was soft, and there was no fear of the pressure used to extract it causing hæmorrhage afterwards, but in two cases this occurred. The advantage of removing the capsule with the lens is the very clear vision that is obtained from the first and the absence of any after trouble from the capsule.

The disadvantages are the great probability of vitreous escaping and hæmorrhage into the eyeball and consequent loss of vision.

NEW OPERATION FOR CATARACT AT CIVIL HOSPITAL, AMRITSAR.

BY MEHER CHUND, RAI BAHADUR.

THE method described in this paper was first adopted by Dr. Mulroney, of Amritsar, in 1890, and has been followed by me with some slight additions in a very large number of cases.

The operation consists in the removal of the entire lens in its capsule by the manipulation and by lower section, without iridectomy.

The eye having been cocainised with 4 per cent. solution and washed with 1 in 2,000 parts of corrosive sublimate lotion, the spring speculum is introduced, but not fixed.

The incision in the right eye is performed by standing behind the head, and that in the left eye is done by standing in front, and on the same side of the patient. The incision is made by introducing the point of the linear knife into the corneo-sclerotic junction on the outer side of the globe, on a level with the lower margin of the undilated pupil, the counter-opening being made a little lower on the inner side, and then the incision is completed in the usual way through the cornea.

Pressure is now applied with a flat scoop, or a strabismus hook at the upper border of the cornea, till the edge of the lens presents itself into the incision, and then counter-pressure is applied by a curette below the incision; by this process the iris, which is often in the way, recedes, and the lens gradually projects, and when nearly half of it is out of the wound, the pressure is withdrawn and the speculum removed. After this, the pressure with the thumb is re-applied to the globe through the upper lid, and counter-pressure applied to the ball of the eye below the wound on the sclerotic coat, with a scoop; the pressure now is very gently and carefully regulated, till two-thirds of the lens come out of the wound. Pressure is now again removed, and the patient is directed to close the eye, and look towards his feet, when in most of the cases the lens slips out, the iris contracts, the edges of the wound become adjusted, and escape of vitreous prevented. In cases where expulsion of the lens is retarded, it is completed by the aid of a scoop or a pair of iris forceps.

In those cases where the soft cortical substance of the lens comes out, but a hard nucleus remains behind, the capsule is very liable to rupture, unless tact and patience are exercised, till the nucleus also protrudes.

If, after extraction of lens, a bead of vitreous shows itself, which, however, is rare, its connection with the main body should be cut off by a pair of scissors, instead of wiping it off; a slight escape of vitreous which occasionally occurs is of no consequence, as far as the result is concerned, the patient invariably having good sight.

About 3,400 operations have been performed by this method in the Civil Hospital, Amritsar, out of which nearly one-third was performed by myself.

Removal of entire lens in its capsule, by manipulation by lower segment section, without iridectomy.—The advantages of the lower operation as compared with the upper, are—

1st.—It is easier to do.

2nd.—Spasm of the superior rectus, which invariably results whenever the eye is touched, cannot interfere with the completion of the incision when once the operation is commenced, and also can be disregarded when pressure is applied to remove the lens.

3rd.—Less risk of escape of vitreous, as the lower part of the eye is more exposed to view and more easily manipulated by pressure, during the extraction of the lens.

4th.—Spasm of the superior rectus in the upper operation tends to gape the edges of the incision, and so increases risk of escape of vitreous at the time of operation and later on, and, by delaying union, increases the risk of sloughing of the cornea. In the lower operation, no amount of spasm of the superior rectus will cause gaping of the incision, as the incision is at the further end of a segment of another circle, by which I mean the superior rectus being inserted into the sclerotic can act only on that segment of the circle formed by the sclerotic, and only to a slight extent on the neighbouring portion of the segment of the second circle (cornea), and the farther removed the incision in the segment of the second circle is, the less the traction, and consequently the less the gaping. We know the eye consists of two segments of different circles, the sclerotic and the cornea. The superior rectus will tend to gape an incision placed anywhere between its ocular attachment and the sclero-corneal junction in front of it; but if the incision be in the cornea itself, the cornea being a segment of another circle, the incision will gape much less than if the cornea were the segment of the same circle, as the sclerotic, and the more we move the incision towards the meridian of the corneal circle, the less the gaping, and once we pass the meridian no gaping can occur. Further, whenever the eye is inflamed or over-sensitive, as after an operation, it is invariably turned upwards under the upper lid, and we know the upper is very much stronger than the lower lid, and any attempt to press the upper lid upwards with the fingers so as to open the eye cannot be done without pressing on the eye ball. It follows, then, that to inspect the incision after an upper operation is far more difficult, and at times positively dangerous, from the pressure used, than when the lower operation is done, in which slight pressure on the lower lid against the malar bone is sufficient to expose the incision.

The advantages of not doing an iridectomy are:—

1st.—No instrument is passed into the anterior chamber except the linear knife in making the corneal incision.

2nd.—The iris is not injured, hence there is less chance of subsequent iritis, and consequently less risk of inflammatory action extending to neighbouring structures and endangering the eye.

3rd.—A clear circular mobile pupil, instead of a large gaping irregular pupil, which is not only unsightly, but seriously interferes with clear definite vision.

The advantages of removing the lens entire in its capsule are—

1st.—It minimizes the chances of iritis supervening, as there are no tags of torn capsule or particles of lens cortical substances present to set up irritation. I find iritis extremely rare, since I commenced removing the cataract in its capsule whereas it frequently results when the lens is removed and the capsule retained, as in the usual operation.

2nd.—There is no necessity for a secondary operation to remove opaque capsule.

3rd.—I have repeatedly seen patients come to the hospital, months after a cataract operation had been performed in which the lens was removed by opening the capsule by means of a cystotome, complain of blurred vision amounting to marked astigmatism in some cases. The pupil in such cases is clear, the cornea clear and even, and the line of incision almost invisible. If the eye be examined by the direct ophthalmoscopic method, the capsule will be seen, although *perfectly transparent*, wrinkled into folds. In such cases tearing the capsule across with a needle invariably gives good vision. This wrinkling into folds of a transparent capsule is best seen in those cases in which the capsule is opened by the point of the linear knife when traversing the anterior chamber in making the corneal incision. If the capsule is retained *in situ*, and remains transparent, which can only occur if its attachment to the suspensory ligaments, from which it derives its nourishment, is not destroyed, then it must wrinkle into folds when the eye recovers after the operation, for being non-elastic and not having the support of the lens substance, there is nothing to prevent it from forming folds. Now, this cannot occur when the lens is removed entire in its capsule, and I find, as a matter of fact, that the vision in such cases is clearer and more defined than when the capsule is left behind.

4th.—You can operate on an immature cataract without running the risk of settting up iritis or having to do a second operation, to remove opaque cortical matter and capsule, the objections to operating on an immature cataract. The disadvantages are—

1st.—Greater skill and more delicate manipulation required, which cannot be acquired by all, and only after much patient practice by some.

2nd.—It is a more difficult operation.

3rd.—Risk of vitreous escaping by misdirected, excessive or unequal pressure during manipulation.

4th.—A slightly larger incision.

5th.—The capsule sometimes bursts when the lens is on the point of escaping, and as in such cases the attachment of the capsule to the suspensory ligament is destroyed, and its source of nourishment cut off, if left behind, it invariably turns opaque and requires subsequent removal. So, if this accident occurs, I always endeavour to remove the capsule with iris forceps, even at the expense of a slight escape of vitreous; and should it occur I can generally remove it within the first two or three days after the operation; for I find it better to open up the wound and remove it early rather than wait, for its presence invariably sets up iritis and endangers the eye. I am fully convinced the capsule can never undergo complete absorption; it may shrivel up and fall behind the iris so as to be out of the axis of vision, but being fibrous in structure, it can never be completely absorbed. In some cases, at the time of operation it falls behind the upper part of the iris out of view, and if I fail to grasp and remove it after two or three attempts I leave it, and on the second day after operation I almost invariably find it opaque, filling the pupil and easy to remove. I never dilate the pupil with atropine before the operation, as I find by having an active pupil, although there may be a risk of bruising the circular fibres of the iris by the passage of the cataract through the pupil, there is less chance of a bead of vitreous following the cataract, since the iris at once retracts within the anterior chamber as soon as the cataract escapes; whereas should the pupil be dilated with atropine it remains prolapsed after the escape of the cataract, and has to be returned into the anterior chamber by a curette or scoop.

A 4 per cent. solution of hydrochlorate of cocaine is instilled three times into the eye, once 10 minutes before the operation, again 5 minutes before, and the third time just before the operation is commenced. After the operation, a layer of damp lint soaked in fresh yellow wash is applied, and both eyes fixed with a light muslin bandage without any pad. On the third day the lint and bandage are removed and reapplied, and so on for four days, after which the bandage is discontinued, the pupil dilated with atropine, and a layer of damp lint worn as a screw in front of the eye.

In those cases in which the capsule has burst and retained, I instil a drop or two of liquor atropine after the operation.

No antiseptics, excepting fresh yellow wash, are used. The eye is washed with boiled distilled water and dressed with yellow wash, and the instruments washed after each operation in boiling distilled water.

Generally on the eleventh day the patient is well enough to go out. All are supplied with cataract spectacles before discharge, + 11 D for distance and + 14 D for reading, suit the majority of such patients. Pauper patients are given spectacles gratis, and those able to pay can purchase them from the stock in the hospital.

Eight hundred and twenty-four cataract operations were performed in 1892 and 1,145 during 1893 by the new method, and in current year up to the end of November 1894, 755 operations have been performed, out of which 677 were successful (or about 90 per cent.)

ON THE TREATMENT OF CERTAIN CASES OF IMPAIRMENT OF VISION AFTER SUCCESSFULLY OPERATING FOR CATARACT BY LACERATING THE HYALOID MEMBRANE.

BY G. H. FINK,
Surgeon-Captain, I. M. S.

I WOULD venture to offer a few remarks on a certain condition of the eye, which impairs vision in a small percentage of cases in India after a successful operation for cataract has been undertaken.

The methods of operation for cataract which I have adopted for the last six years, in over 1,000 operations performed by myself, are the recognised methods of European surgery under as strict antiseptic precautions as are at my command, and with such modifications as are suggested to me in considering my patient's powers of endurance and fitness from every conceivable point.

In our hospitals in India, which are frequented chiefly by the poor, we witness various grades of poverty and various conditions of robustness of health, which need our full consideration and demand most careful attention, in some cases necessitating our fitting our patient for such a grave operation as we are about to undertake. Unfortunately, the ignorant do not see the force of waiting to undergo this preparation, and many of them abscond. We are then compelled to undertake our operations on the spur of the moment, without further consideration. Skilfulness and dexterity of course are gained by a wide experience; but that surgeon is most skilful and dexterous who pays most regard to the *pros* and *cons* of his case before him, ere he lifts his scalpel or his knife to undertake an operation.

The question of iridectomy, about which there has been so much controversy of recent years among British surgeons, seems to attract more attention than the condition of the patient as to his fitness or otherwise for the operation, and the momentous question has been in many matters overlooked, while iridectomy or non-iridectomy has been held responsible for inflammation of the tissues of the eye, if it should set in.

The question of iridectomy undoubtedly is one of great importance to the ophthalmic surgeon; but upon it alone does not hinge the whole results of our operation. I maintain that our methods of operation on various patients require to be carefully selected in the operations for cataract, as in the treatment of pneumonia or any other disease.

I feel that the surgeons of the present day in India have achieved the results that they have, by skilful care in steering their patients through difficulties which beset them, and I believe that the question of iridectomy is decided upon wherever there is some distinct indication for such.

The matter of iridectomy or non-iridectomy by myself is one of selection, after fully considering the nature of the cataract and the condition of my patient.

"Never perform iridectomy if you have no special and immediate reasons to do so."

The special and immediate reasons which I take into consideration are—

(*a*) The nature of the cataract. The large nuclear and black cataracts are generally difficult to extract without iridectomy, because the lens is large and hard, and in extraction the pressure and strain on the iris is too great, whilst the sudden relief of tension from behind ruptures the hyaloid membrane and vitreous escapes. In cortical and fluid cataracts no iridectomy is required.

(*b*) The condition of the cornea. If there be the slightest indications of haziness or irritability around the edge of cornea, iridectomy is performed.

(*c*) Glaucomatous tendency in the eye operated on, or in the other eye.

(*d*) In cases where there is a central leucoma present.

(*e*) Where the iris has accidentally presented in front of the knife and cannot be moved out of the way, and has therefore to be boldly cut through.

The next question as to whether the capsule of the lens should be pricked or not is dealt with according to the following circumstances:—

(*a*) The nature of the cataract. If fluid or cortical, it can be easily extracted without laceration of the capsule. There are exceptional cases where I have extracted nuclear, striated and black cataracts without pricking the capsule. It is always worth trying to extract the cataract without pricking the capsule, and if it comes away easily, well and good; if not, you prick the capsule, and the immediate effect of this, if done according to Tweedy's method, is to produce an increased dilatation of the pupil frequently through which the lens gains an easy exit. This fact has led me in several cases to decide upon iridectomy or not. If I find that by pricking the capsule the pupil immediately dilates, I have very rarely found it necessary to perform iridectomy, for the lens comes away very easily by gentle coaxing, with that degree of pressure with the curette which is necessary.

You can easily understand that such a cataract as a Morgagnian cataract, which consists chiefly of fluid cortex, with a small nucleus floating in it and enclosed within a capsule, would easily adapt itself to the opening of the pupillary area, which is already dilated by means of atropine, and the only difficulty which is experienced in the extraction of such a cataract whole in its capsule and without iridectomy is the degree of pressure to be exercised in coaxing it out, which pressure is a sort of *muscular sense*, which only the experienced hand could fully appreciate the meaning of.

Morgagnian cataracts are peculiarly adapted to such operations, owing to their power of accommodating themselves to the opening of the pupillary area through which they gain an easy exit.

It is my practice, after extracting a cataract, to test the patient's vision immediately by holding up fingers to count, in order to satisfy myself that vision is present, and that no cause of impairment exists which can be removed at one sitting. It also satisfies that eagerness and curiosity of the patient and his friends; otherwise there is frequently an attempt made during after-treatment to remove the antiseptic plaster or the pad and bandage. Of course, the closure of one eye or both after operation is merely a matter of experience; but I prefer to cover both and use the antiseptic plaster, which is a solution of gum and mercury lotion (1 in 5,000), into which a piece of blue silk is dipped, with two slits or openings for either canthus to discharge secretions. The advantage of the plaster over the pad or bandage in India is that it is cooler, and that it adheres like a splint to the eyelids. On the patient endeavouring to remove it, it adheres to the downy hairs and produces pain by pulling on them, and the attempt is abandoned.

I claim for the immediate testing of vision after a cataract operation another great advantage, namely, that in about 1 to 1½ per cent. cases operated on, I have discovered, after the most successful operation for cataract has been performed, the patient has declared that he could not see at all. On testing vision by holding up fingers to count, the patient is not able to see to count, but says that something is moving before his eyes. To the naked eye of the operator, there seems no cause whatever to account for this result. The centre of the pupillary area being black, and no soft cortex or membrane is seen to be floating about. In India it can generally be seen if present, owing to the splendid light one generally has. On examining the eye with a magnifying glass carefully, a diffuse and deep haziness is observed in the centre which gradually fades away towards the periphery. In my first case, I endeavoured to remove this haziness with the point of the cystotome introduced to the centre of the area very carefully and under antiseptic precautions. On trying to remove the hazy membrane, the cystotome met with some resistance, and on further attempts, it was noticed that the membrane gave way, the hazy area was now occupied by a jet black appearance, and on removal of the cystotome, a few drops of vitreous escaped. I immediately closed the lid over the eye, allowed it to rest for a while, and then very carefully, by means of Desmarre's retractors, lifted the upper lid and tested vision with the fingers. The patient said he could see, and saw very clearly indeed. I closed the eyes, applied glycerine and belladonna to the eyebrow, applied the antiseptic plaster, and as an additional safeguard, the pad and bandage over the plaster on drying of the same. The following prescription was also administered:—

R Quiniæ Disulphatis gr. ii
Opii gr. ½-¼
Mix and make a pill. Sig: To be taken thrice a day.

I have since had several cases of this peculiar condition after the operation for cataract has been successfully performed, and have invariably dealt with them in a similar manner with the most satisfactory results to vision.

Ophthalmologists have varied in their opinion from time to time as to the identity of the posterior capsule of the lens, with the hyaloid membrane; but the most recent opinion is that they are not identical, but distinct membranes. Such being the case, I am firmly of opinion that in aphakic eyes in which this peculiar form of impaired vision exists, the hyaloid membranes is responsible for this condition after a successful operation for cataract has been performed.

The escape of vitreous externally in such cases is scarcely appreciable, although no doubt it advances into the anterior chamber in some cases; but, as a rule, if the operation be performed with a delicate touch, and the cystotome removed carefully and quickly, and the eyelid closed over gently for a little while before testing vision again, no external escape of vitreous occurs.

Is this condition a secondary cataract, or is it the form of cataract known as posterior polar cataract or what?

Fuchs says with regard to *cataracta secundaria*: "It often happens, even in cases in which the operation has been well performed, that the result of the operation is impaired by the retention of portions of the cataract. This happens particularly when the operation is done on immature cataracts; but by no means fails to occur also in those that are mature or hypermature. If the anterior capsule is thoroughly opened, the portions of lens left behind (if they were not already opaque previously) grow opaque, swell up and become absorbed. In this case, therefore, a pure black pupil is ultimately obtained. But if the layers of the capsule become agglutinated early and shut off the remains of lens substance from the aqueous, these remains are not absorbed, but persist as a white membranous opacity. This is called "after cataract" (*cataracta secundaria*). If this is present in only one part of the pupil, while another part of it is quite clear, the sight may be perfect. But if the whole pupil is filled by the secondary cataract, the sight is diminished in proportion to the density of the opacity. It may also happen that the after-cataract does not develope until later on; the epithelium of the anterior capsule which has been left behind proliferating and inducing a secondary thickening and opacity in the latter. After-cataract, when it interferes with sight, requires a secondary operation, namely, discission or simple linear extraction. The secondary operation should be performed not sooner than four weeks at earliest after the cataract extraction.

Swanzy classifies secondary cataract under the following heads:—

(a) Posterior polar cataract.

(b) Total secondary cataract often ensues upon contact of the lens with inflammatory products in the eye, *e.g.*, where false membranes have been produced by inflammation in the uveal tract. It is sometimes then called *cataracta accreta*, when the iris or ciliary processes are adherent to it. Cataract is also

caused by detachment of the retina, intraocular tumour, absolute glaucoma, etc. The reason of this is that the lens in these cases imbibes abnormal nutrient fluid from the diseased tissues with which it is in contact.

Such cataracts often undergo a further degeneration and become calcareous. These secondary cataracts rarely come within the range of treatment, as the diseases which give rise to them are usually destructive to sight. When occasionally they can be dealt with, they should be extracted.

The term "secondary cataract" is also used in cases in which, after a cataract extraction, the capsule of the crystalline lens which is left behind presents an obstacle to good sight.

Meyer, Freeland Fergus, state: "Under the name of secondary cataract are individual opacities of various kinds, which are formed in the pupillary field after a cataract operation, and which prevent the complete re-establishment of vision.

"As a general rule, we must take care not to perform any secondary operation shortly after the extraction of cataract. The time which we must wait varies with the duration and severity of the inflammatory process which the eye has undergone. We should decide to perform a secondary operation only when all traces of irritation, such as swelling of the lids, photophobia, and pericorneal injection have disappeared. If we do otherwise, we are apt to revive the inflammation, and not only lose the benefit which may be derived from our operation, but also find that other opacities are added to those which already exist. It then becomes necessary to subject the patient to another long period of waiting before we can attempt another operation on the eye."

Noyes states: "In a large proportion of cases, some membraniform obstruction appears in the pupil after the operation. We have every grade, and may speak of the simple and the complicated secondary cataract. The simple may be extremely thin and nearly transparent or quite thick and opaque.

"The complicated varieties of membranous cataract appear immediately. The rule with these is that they thicken and contract, and draw the adherent iris up to the wound, and may obliterate the pupil. Consecutive changes may be severe, and the eye go into atrophy with detachment of the retina, the vitreous become fluid, and the changes which cyclitis causes may ensue. From this may follow also the irritation which sets up sympathetic ophthalmia. The time when secondary cataracts may be operated on is not easily determined, but is seldom not less than within four weeks or three months; never until all irritability of the eye has ceased; and this may be after six months or a year."

With regard to posterior polar cataract (*cataracta polaris post rior*) Fuchs states: "Cataracta polaris posterior consists of a small white dot at the posterior pole of the lens, which, on account of its deep location, is generally to be discovered only with the opthalmoscope. It belongs to the posterior capsule, upon the posterior surface of which it is deposited, hence also called posterior central capsular cataract. Posterior polar cataract is congenital, and it dates from the time when the hyaloid artery passed through the vitreous to the posterior pole of the lens. When this disappears incompletely, some of its tissues remains upon the posterior capsule. Hence, we sometimes find posterior polar cataract simultaneously with persistence of the hyaloid artery. The interference is inconsiderable when the cataract is small.

Treatment—none.

The anterior and posterior polar cataracts are capsular, while the partial stationary cataracts are all lenticular.

Swanzy, Meyer and Freeland Fergus, together with Carter and Frost, and Noyes of New York, all agree that posterior polar cataract is situated in the posterior layers of the lens or its capsule, which converge towards the posterior pole. Some believe it is congenital or acquired or both; but all are agreed with the point that it has some connection with deep mischief within the eye as the result of disseminated choroiditis, retinitis pigmentosa, diseased vitreous or other deep seated changes of the inner tunics of the eye. Noyes, of New York, states that it is associated with hyalitis and myopia. Juler regards it as a spurious form of cataract, since there is no opacity of the lens or its capsule, but merely a small piece of the capsulo-pupillary membrane adherent to the latter, and that the acquired form is progressive. Juler also clearly states that the congenital form is probably in some way connected with imperfect absorption of the fœtal hyaloid artery, and cases have been recorded in which a minute thread, corresponding in position and size to that structure, has been visible, passing back from the opacity towards the optic disc. I am of opinion that Juler's view of this particular form of cataract is the correct one, namely, that it has no connection with the posterior layer of the capsule of the lens, nor with the lens itself, for the simple reason that in cases where the lens has been extracted whole in its capsule, it is found to exist, and the only conclusion I can draw is that its position is in the fossa patellaris of the hyaloid membrane. That it may be congenital or acquired, I also agree with, and that the latter form is of a progressive nature.

I place before you the accompanying diagrams from plate XV of Juler's work on the Eye, showing posterior polar cataract as seen by the ophthalmoscope (red) and by obliquefocal illumination (black). In both these diagrams the cataract presents a stellate appearance, which, in the congenital form is explained by the traction of the fine shrivelled thread of the fœtal hyaloid artery in the centre of its attachment to the hyaloid membrane at the fossa patellaris. Moreover, when the eye is examined under the ophthalmoscope or by obliquefocal illumination, there is the act of accommodation which also comes into play, and the lens which alters its convexity, and in doing so carries the posterior capsule with it forward, still further draws upon the central line of attachment by its contiguity to the hyaloid membrane; hence the stellate appearance.

Whether the acquired form of posterior polar cataract is due to diseased condition of the deep tunic of the eye alone, or can be produced by abnormal tension of the globe, or by pressure of the swollen and opaque lens against the hyaloid membrane in the process of its development and maturity, whilst in some cases false membranes form in the fossa patellaris by reason of the pressure exerted, is a matter for future investigation and enquiry ; but whatever the changes might be that take place, I am inclined to give their particular form of impairment of vision after successfully operating for cataract the name of " hyaloid cataract," a term which is given to crescent-shaped opacities of the lower portion of the posterior capsule, and which should no longer continue to be applied, since the hyaloid membrane is no longer considered identical with the posterior capsule of the lens.

The conditions observed by myself after the performance of over one thousand cataract extractions by various methods to meet the particular form of cataract, together with the condition of the patient and his eye, do not lead me to suppose that this particular impairment of vision can occur after a successful operation for cataract has been undertaken with all the care and precautions possible. The changes might be secondary to the developmental period of a cataract, or to the progressive changes of diseased inner tunics of the eye ; but the latter condition, in my opinion, is rare, and, if progressive, I believe it can be arrested by the operation of discission or dilaceration of the hyaloid membrane with a light touch of the cystotome. The posterior layer of the capsule of the lens might present false membraniform attachments by agglutination, owing to its proximity to the hyaloid membrane in the fossa patellaris, and in such cases it is advisable to extract the lens whole in its capsule, and if there still be impairment of vision by testing with the fingers, then laceration of the hyaloid membrane vertically from below upwards should be undertaken immediately.

The changes in the vitreous, choroid and retina might possibly be secondary to changes by pressure and adhesions in the fossa patellaris. It is a curious fact that in lacerating the hyaloid membrane in this condition, the vitreous has no tendency to escape rapidly or in large quantities externally. It is rare for it to do so if the operation be done with a light touch. It is probably due to some change occurring in the external wall of the canal of Stilling which passes through the vitreous and causes the cellular structure within to form fine adhesions which support the fluid structures as if in the meshes of very fine stroma. Particularly might this be the case where, as Juler states, the remnant of the hyaloid artery is a fine thread, which acts almost like a foreign body and sets up changes. We know that fœtal remnants are capable of lighting up mischief in adults by their mere presence.

I am anxious to impress upon you the importance of testing vision immediately after cataract operations. It is, I feel, now of the utmost importance to note the changes which occur in every eye which gives symptoms of cataract formation, making an ophthalmoscopic examination from the very outset of the disease until its full maturity. In our dispensary practice in India, this is a difficult matter frequently, and only exceptionally can we follow a case in its earliest stage to the termination. It is better for the surgeon to satisfy the curiosity of his patient and his friends in the matter of vision after the operation, rather than run the risks of examination by the patient and his friends, whose curiosity will be satisfied in the wards during your absence. Dirty fingers and rough hands remove the plaster or pad and bandage and the eye is lost. I claim for this particular mode of treatment of impairment of vision as great an advantage as the modern operation of litholapaxy has over lithotomy. It is far better to remove the impairment at one sitting, rather than wait weeks or months after cataract extraction has been performed. The operation of the discission or dilaceration for secondary cataracts as performed at the present day cannot be undertaken from four to six weeks after cataract extraction has been performed. Long waiting, in some cases for months, certainly gives time for firmer adhesions by false membranes which increase the risks of a secondary operation.

The escape of vitreous, which is regarded as one of the accidents in cataract operations, need not be feared so terribly after the eye has been deprived of the lens. It certainly is an accident to be feared before the lens is extracted for obvious reasons ; but in this particular impairment, it certainly seems rather an advantage, since vision is clear, and remains so till the termination of the treatment in hospital, which is about fifteen days on an average. I have seen some of my patients a year or two after the operation, and have only been obliged to adjust their spectacles, whilst in other respects there has been clear vision.

Very seldom has it fallen to my lot to perform the secondary operation for cataract; and I have the greatest faith in cases of doubt, where pieces of cortex have been left or lurk behind the iris, in the use of grey powder grains iii to v, Dover's powder gr. iii to v three times a day. Occasionally, when these fail, iodide of potassium gr. iii to v, water ounce i, will be found most useful at the very outset of the treatment; but their effects need to be most carefully watched daily, and in the case of the former, ptyalism must not be allowed to come on, whilst in the latter, conjunctivitis and lacrymation sometimes set in; but the drug must promptly be stopped when this is observed. I believe that these drugs when used as directed have powerful absorbent properties, and, if persevered in, I am convinced that secondary cataracts ought to be less common than they are at the present time.

DISCUSSION.

J. F. Tuhy (Saharanpore) remarked that the plasters spoken of by Dr. Fink were first used by Snell, and were described in Braithwaite's Retrospect about seven years ago. He recommended gum, as gelatine was so difficult to obtain in

India. The gum was dissolved in 1-3000 or 1-5000 perchloride of mercury. He thought the advantages of the plasters had not been sufficiently appreciated by Indian ophthalmologists, as they are cool, form a splint to the eye, cannot easily be removed by the patient, and admit of the eye being readily observed.

M. G. Naidu (Madras) thought that a compromise between iridectomists and non-iridectomists was possible. Indian oculists appeared to favour extraction without iridectomy, while European ophthalmologists preferred performing iridectomy before extraction. To him the explanation of this portion seemed to be that in India cataractous lenses were, as a rule, much softer than those met with in Europe. The cause of this difference might be ascribed to the difference in food and drink of the two continents. Animal diet, spirituous liquors, rheumatism and gout might account for hard lens in Europe, while rice and wheat might explain the softer cataractous lenses of India. To him the short and general rule seemed to be this: For Europeans and Mahomedans an iridectomy should be done previous to extraction, while for Hindus simple dilatation of the pupil with atropine was the only preliminary necessary.

C. Mitra (Kashmir) stated that he had adopted Græfe's method in Kashmir, where cataract was very common. The question of a preliminary iridectomy was decided on from the especial features of each case. He could not see that the decision to adopt iridectomy depended solely on racial considerations. He emphasised the need of the strictest antisepsis by pointing out the benefit his own practice had derived from adoption of such measures. Personally he found iodoform as an after dressing too irritant, unless applied on a lint pad in the form of ointment.

J. G. T. Hearn (Ranchi) related his own experience of failure to obtain good results, till he placed the instruments in boiling water previous to operating In no case, since the adoption of this procedure, had suppuration occurred.

D. J. M. Shah (Junagadh), in cases of double cataract, recommended simultaneous removal to save time, and to give the patients the most benefit, as they never return for an operation on the second eye if that on the first is successful.

Bhogwan Dass II (Jullunder) stated that he did not perform a preliminary iridectomy unless the pupil were irregular and the iris adherent. Having made the inferior incision in extracting the lens, he made pressure above at the top of the cornea with a scoop and below on the sclerotic. By means of this procedure the lens slid out gently. He was strongly in favour of antiseptic dressings. By using them he found that in a series of over 500 cases the percentage of success had risen from 83 to 95.

J. Chaytor White (Mozuffernagar) stated that he found that many of the eyes met with showed increased tension (T + ·5 + 1 + 2). Any operation which in any way produces external pressure on the lens and contents of the eye was apt to cause rupture of the hyaloid. He found that in Teale's shallow flap operation increased pressure was produced at the moment of turning the knife from the plane parallel to the plane vertical to the iris. He had consequently abandoned the use of Taylor's knife, and now used a Græfe, with a previously dilated pupil. He believed the shifting of the incision away from the base of the iris (sclero-corneal junction) to be of real value in preventing prolapse of the iris. He was of opinion that any operation performed without iridectomy should not have the incision at the sclero-corneal junction.

A. Powell (Cachar) was surprised that such a strong irritant as 1-2000 perchloride solution could be used with impunity. He had often known pain and spasm follow the use of 1-4000 solution. He failed to see the advantages of the inferior section. He did not know that one rectus muscle was to be feared more than another. He thought loss of the vitreous had been too lightly regarded by previous speakers. He preferred a secondary operation, if necessary, to losing the vitreous. He had given up iridectomy. Starting with a short flap, the flap had gradually become shorter, and the incision lower down, till he now performed with a Græfe's knife —an operation very similar to Teale's. In 37 out of 80 cases operated on this year atropine was instilled. In four of these cases the aqueous failed to reform. He wished to enquire if others had met with the same large proportion in the use of the drug. He removed the cortex with a spud or M'Keown's irrigator. The advantages of the operation were less pain to the patient, and the absence of hæmorrhage to obstruct the field of operation. The disadvantage of having the scar so near the pupil was the occasional occurrence of traumatic astigmation from "kinking" of the cornea.

H. Gidney found perchloride too strong an irritant, and used boracic acid (1 in 40) with better results. He cut the capsule whilst making the corneal incision. He was adverse to operating on both eyes for cataract at the same time.

F. P. Maynard (Calcutta) did not think the impairment of vision described by Dr. Fink could be due to the formation of secondary cataract. If it had been, the pupil would not have been perfectly black, nor would the appearances been those described. Moreover, secondary cataract could not develope immediately, its rapidity of formation and extent would depend upon the quickness with which the lens matter and capsule left behind were shut off from the dissolving influence of the aqueous humour.

Nor would posterior polar cataract explain the case. If due to the congenital cause, the incidence of this condition of impairment of vision would be the same in patients with other diseases, as in those with cataract. Nor did the acquired form of posterior polar cataract explain the condition, for laceration of the structure mentioned in the paper would not improve vision. Indeed the very existence of this acquired condition contra-indicated operation. The speaker was of opinion that there was no need to describe the condition mentioned in the paper as hyaline cataract. He was of the opinion that in these cases the cataract was immature. In extraction some transparent layers had been left behind and escaped notice. Refraction through these layers, immediately after operation, and before much physical change could occur in them, quite accounted for the impairment of vision.

The practical outcome seemed to be that in operating on immature lenses, it might be better to take the note of slight vitreous prolapse and lacerate the posterior capsule to prevent, as far as possible, secondary cataract formation.

He also pointed out that the method of cataract operation, described by Assistant-Surgeon Mehr Chand, was by no means new. It was described in standard text books as Pagenstecher's operation.

CONJUNCTIVITIS IN JAILS WITH AN ANALYSIS OF 750 CASES.

BY A. RAGASINGHAM, M.B., C.M.,

Colombo.

THE following notes were compiled from the cases of conjunctivitis treated at the Convict Hospital, Colombo, from 1st January 1894 to the 7th November of the same year. This jail is the largest in the island, and the cases treated here may be taken as a fair type of the disease as met with in the Ceylon prisons. Some of the cases treated here were extremely mild, while others were of the most severe type, and a very large number may be assigned to the class of considerable severity.

It would hardly be necessary to premise here that among the jail population all diseases, especially conjunctivitis, would be brought under treatment from the very onset; and hence the relative value of the following figures and the conclusions drawn from them must be placed on a somewhat different footing from the statistics of the civil hospitals and private practice:—

Table showing the number of days spent by patients in hospital.

No. of days spent in hospital	No. of patients.
1	12
2	153
3	165
4	118
5	71
6	44
7	29
8	23
9	16
10	20
11	5
12	12
13	8
14	2
15	14
16	5
17	6
18	3
19	3
20	2
Above ... 20 days.	Rest.

Almost all the cases treated in this jail were in males, and the females, though few in number comparatively, were almost exempt from this disease; and hence it would be reasonable to conclude that male prisoners, from hard work, exposure to the sun, and the intrinisic nature of their occupations, are more liable to this disease than females.

By careful calculation, the average stay in hospital of an individual is found to be 5·37 days, the maximum being 76 and the minimum one day. But when a patient had stayed in hospital more than 16 days, some other complication or intercurrent disease must be searched for. The annexed table and chart could make this point clear; but 16, 25, 29, 32, 38, 46 and 56 would be regarded as unusually prolonged periods.

It is almost self-evident that certain trades and occupations, such as masonry, lime-making, stone-cutting, stone-polishing, sledging, brick-making, would predispose labourers to conjunctivitis, and these presumptions are fully borne out by figures. The annexed table and chart would make this plain:—

Occupations in Jail.	No. of cases.
Mason's party	374
Husk-beating	128
Sand party	32
Levelling party	18
Latrine party	15
Fencing party	14
Cleaners and sweepers party	10
Cabbook Cutting-party	7
Stone-cutting and breaking party ...	6
Hospital attendants	3
Lamp lighter	1
Other parties	...

Diagram—

No. of cases treated in the various months.—

January	40
February	101
March	110
April	121
May	57
June	70
July	62
August	64
September	53
October	51
November	16
Total cases ...	745

I should not omit to mention here that trachoma forms an important factor, both in causing this disease and in bringing on unfavourable results, and it is in such cases that general ulceration and sloughing of the cornea are liable to supervene, owing to the nutrient material failing to reach the corneal cells. If trachoma and œdema of the lids should exist simultaneously, the unfavourable termination would be brought on much earlier.

The various seasons of the year exert a powerful influence both in predisposing to and exciting this disease. Thus April shows the largest number, and October the smallest, according to the statistics of the hospital.

In a jail where the number of inmates is limited, it is not an uncommon thing for one person to be readmitted again and again, at short intervals, for the same disease, and conjunctivitis is no exception to this rule. I should not omit to mention in this connection that in jails a certain number of cases of conjunctivitis are self-induced, and are to be attributed to malpractices, such as the application of the juice of the croton seeds, lime, seeds of the castor oil plant, emplastrum cantharidis, when applied externally for the legitimate purpose of causing a blister. Except in the early stages, such cases cannot be diagnosed from the genuine conjunctivitis.

I have also noticed that in tropical climates, such as Ceylon and India, hypertrophy of the follicles of the eyelids are much more common than in temperate climate like Scotland and England; and I cannot but attribute this disorder to any other influence but heat and direct exposure to the burning rays of the tropical sun. Besides malarial cachexia, from which the great majority of prisoners suffer, must, of necessity, by reducing the system to a state below par, predispose the individual to subacute inflammations.

Symptomatology.—The main symptoms would be the same under all climates; but in the tropical countries, the lids are liable to become swollen and congested more readily, and it is not a very uncommon thing for a slight amount of serous effusion to occur in the sub-conjunctival space; in fact the inflammation runs a more subacute course than in healthy, robust inhabitants of temperate climates.

Treatment.—I would briefly allude to the drugs and methods of treatment pursued in this hospital without entering into unnecessary details. Boric collyrium of the strength of 15 grains to the ounce or thereabout is invariably used to wash the eyes free of all discharges to remove crusts and to keep the lids moist.

As this is a comparatively non-poisonous, and at the same time a fairly potent, antiseptic, it is very acceptable for general use in the wards, especially in jails, where poisonous drugs should be kept out of the reach of prisoners. I have noticed that when a grain or two of sulphate of zinc was added to the boric collyrium, the strength of the latter was considerably increased and the cure expedited, especially in cases of moderate severity. Fomentation by decoctions of tamarind and pomegranate leaves is a time-honoured remedy among the Singalese Mederalays ; and I have no doubt that the astringent ingredient of the leaves has a grateful and beneficial influence meets with the approbation of the natives, just as cold tea is a popular remedy in England.

It is a fairly common thing to meet with cases of conjunctivitis, in which the lids are found to be highly œdematous in addition to the effusion of a thin serous fluid under the ocular conjunctivæ. It is in such cases that I have found the local abstraction of a small quantity of blood from the temples by the application of 2 to 5 leeches of average size most beneficial. Almost instantaneously, the headache and weight in the head would be relieved, and the œdema of the lids and sub-conjunctival effusion reduced. But to derive the full benefit, leeching must be resorted to in the incipient stage of the disease, and not when it it is declining. Counter-irritation to the temples by means of fly-blisters also relieves to a slight extent the œdema and congestion of the lids. Counter-irritation by means of setons to the temple, though invaluable in cases of chronic ulcers of the cornea, are not resorted to in cases of acute conjunctivitis.

Perchloride of mercury collyrium is invaluable when the discharge from the lids is thick, copious, and purulent. Nitrate of silver has been used in the strength of 2, 5, 10 and 20 grains to the ounce. These need seldom be applied more than twice a day, and the two strongest solutions may with advantage be applied by the surgeon himself. A normal salt solution may be used to wash out the excess of nitrate of silver, if necessary, especially when using the stronger solutions.

Collyria containing alum, acetate of lead, &c., are not freely used, as the former is liable to cause perforations in the cornea if the superficial epithelium be abraded, and the latter may cause deposits if ulcers be present in the cornea.

Rose water is a valuable adjunct to most collyria, and it tends to make them agreeable to a patient; besides it has slight astringent properties.

Ice is a remedy which is becoming every day more and more popular with ophthalmic surgeons, and promises to take a very high place among other therapeutic agents. When applied to the head, it relieves the feeling of oppression and weight in the head, and tends to reduce the œdema of the lids. It cures insomnia in certain cases of acute conjunctivitis. As a rule preparations of opium are freely used internally, but chloral and bromide are used if insomnia be troublesome.

I have noticed that a favourable position would tend to reduce the excessive œdema of the lids, especially in old, weak, and debilitated subjects. Thus, if a patient should sleep on the unaffected side, the swelling would tend to decrease, and *vice versâ*. It is routine practice to administer a drastic purgative like magnesium sulphate at the commencement of all cases of conjunctivitis, provided there are no contra-indications, and I have some faith in this preliminary procedure.

Prognosis.—Of the 750 cases treated, all invariably recovered, except one, an old emaciated individual of about 65 years of age, suffering from trachoma. In this case, swelling of the lids was excessive, and in two or three days sloughing of the conjunctivæ set in, and the patient lost the sight in this eye almost completely. Here strong solutions of nitrate of silver proved of no avail, and any other mode of treatment failed. The age of the patient and the condition of the lids would explain the cause of failure.

DISCUSSION.

A. Buchanan (Calcutta) enquired whether the reader of the paper drew any distinction between conjunctivitis and ophthalmia, whether he considered the disease infectious, and whether any precautions were taken to isolate the men who were affected. It would seem that the disease was not confined to men who were working at any particular kind of work, it may therefore fairly be presumed, especially as the numbers were so large, that the disease was infectious. In connection with self-induced cases of conjunctivitis, he remembered seeing in the Raipur Jail a case of conjunctivitis in which on examination several small pebbles were found concealed under the eyelid. In the Nagpur Jail some six cases of conjunctivitis on one occasion came to hospital. There was a strong suspicion that they had caused the injury wilfully. They were all put to work on an oil mill, their eyes having first been bandaged. They were all well in a few days, the cure was extremely quick.

A. R. Ragasingham (Ceylon), in reply, stated that cases of ophthalmia were included under the term conjunctivitis, following a common practice in Ceylon.

Isolation was practised as soon as the first symptoms were observed.

VESICAL CALCULUS IN INDIA, ITS DISTRIBUTION AND A THEORY OF ITS CAUSE.

BY A. E. ROBERTS,

Surgeon-Captain, I. M. S.

It has long been a commonplace of a certain rough and ready order of pathologists to assert the origin of vesical calculus in "salts in the drinking-water." The theory commends itself by its beautiful simplicity ; the patient takes in "stone" at one end and passes it (or fails to do so) at the other, and makes as little demand upon the thoughtful intelligence of those who accept it as it received in the process of its conception. In the course of some observations on the chemistry of the excretions of natives of India, I was struck by the fact, which runs counter to the routine doctrine of the schools, that the excretion of uric acid was far more marked in well-fed natives who never touch meat (or rarely) than in the ordinary European official living in this country. It then occurred to me that some one had attributed "stone" in Norfolk to the excessive farinaceous diet of the people (?Dumplings), and it was thought to be a promising subject to trace the incidence of the disease in its relation to diet in different parts of India, and on arriving at a definite fact of connection to endeavour to explain cause and effect in physiological terms.

Preliminary.—Very roughly, India may be divided into three great agricultural regions :—

I. Extratropical India, the *wheat* region—the great plains of Northern India, where rainfall is moderate or small, and the winter temperature comparatively low. This region almost corresponds with that lying north of the January isotherm of 65. Principal grains, wheat and barley.

II. The damper portions of tropical India, the rice country—all Bengal proper (including Assam), all the region north of the Krishna from the Bay of Bengal to the edge of the Trap country in the Deccan, together with the coast and delta lands of Southern India.

III. The drier parts of tropical India, and all the black soil country, the millet region ; besides the whole Deccan Trap area, with the exception of the west coast ; this comprises all the black soil tracts of Southern India, and a very large proportion of the undulating red soil country. Principal grains, jawari (or cholam), and bajra (or kambu).

1. Rice—The rice-eating people of India number 67 to 70 millions. If we except the deltas of the great rivers and the narrow coast slips, rice is a rare crop throughout the Peninsula ; but where it is grown, it is almost exclusively the local staple crop. For Bengal, no general statistics are available, but taking Rangpur as a typical district, we find one and a half million acres under rice, out of a total acreage of one and three-quarter millions (88 per cent.) It is in similar proportions in Orissa, as also for the deltas of the Kaveri, Godaveri, and Kistna, the lowlands of Travancore, Malabar, Kanara, and the Konkan. Except in Assam, which is agriculturally an extension of the Bengal delta, rice occupies a very subordinate place throughout the interior of the country. In the N.-W. P. it is grown in damp localities, and supplies a favorite but partial article of diet for the upper classes, but here the local supply has to be supplemented by importation ; in the Madras Presidency generally, the area under rice is about 43 per cent. of the total food grain area. In Bombay proper only 14 per cent., in Sind 17 per cent., in the Central Provinces 55 per cent., and in the Punjab but 3 per cent.

Rice requires 36 to 40 inches of water, and requires it at the right time.

2. Wheat.—The great wheat-growing tracts are in the north. The N.-W. P. has 57 per cent. under wheat alone, and 97 per cent. under wheat, barley and millets combined. In the Punjab, the wheat and barley area rises to its highest point, *viz.*, to 61 per cent. of the whole crop area. Beyond this we have 36 per cent. millets, making a total of 97 per cent. under the three chief kinds of cereals. The Punjab therefore very closely approximates to N.-W. P., but its percentage of wheat *per se* is higher.

Wheat is also grown largely in Behar, and to a less extent in the western area of Bengal proper.

In the Central Provinces, wheat covers a large proportion of the food grain area, with millets 45 per cent. It is the chief cereal in Districts Hoshangabad, Narsingpur, and Saugar.

In Bombay only 15% wheat } but the wheat returns vary year
In Sind only 12% wheat } by year & show tendency upward.

3. *Millets.*—Millet is the staple food of India, taking it all over. Excluding rice tracts, millet is grown more largely than any other grain from low down in Madras to Rajputana in the north. The common kinds are :—

(1.) Great millet (*Sorghum vulgare*)—"joar," "cholam."

(2.) Spiked millet (*Pennisetum typhoideum*) "bajra," "kambu." This latter is the crop of South and Central India. In Mysore and neighbourhood, "ragi" takes first place. All millets rank as dry crops, and are watered by rainfall, and are sown under either monsoon. In the following table Mysore is shown to crop 96 per cent. of rice, but this is in the lowlands ; in the uplands, dry crop ragi rises to 77 per cent. of the total cultivation—or 84 per cent. of total food grain area. The total area, under all millets in Bombay and Scind, may be taken at 83 per per cent.—in Central Provinces as 39 per cent., in Punjab 36 per cent., in N.-W. P. 40 per cent.

Plan of Food,—Staple Areas.

AREA.	RATES (per cent.) OF AREA UNDER THE PRINCIPAL FOOD GRAINS.			Total Population.	Population eating rice.
	Wheat and Barley.	Millets.	Rice.	Millions.	Millions.
Punjab ..	61 %	36 %	3 %	18¾	1
N.-W. P. and Oudh	57 %	40 %	3 %	45	4
Bengal Proper ..	a	a	88 % (?)	69¼	43
Assam ..	a	a	60 % (?)	4¾	3
Central Provinces	45 %	a	55 %	9¾	3
Behar ..	97 %	a	3 %	2⅔	a
Bombay ..	15 %	71 %	14 %	16½	2
Madras ..	a	57 %	43 %	31	10

NOTE.—"a" signifies no figures available.

The materials for the above sketch, and all statements as to figures, are taken from the *Imperial Gazetteer*, corrected up to 1883.

We have only to add that the rice-bearing areas (Deltas and Coast) are approximately those also where fish and fresh fruit also enter far more largely into the diet of the people, than in the millet and wheat regions ; in the latter especially are fish and fresh fruit wanting. With this table before us let us set down at once the relative incidence of calculus of the bladder, in the various areas, as above. The figures we give are the annual average prevalence, of a varying number of years, as shown by all the various operations for calculus, and great care has been taken to search all available records, though these are in many cases very imperfect, and kept on a different plan in nearly every Medical Administrative Area. We are not aware that previously anything nearer than a rough guess has ever been made as to the prevalence, relative and actual, of calculus in India. The following are the data extracted from the reports of the various Administrative Medical Officers. I am also indebted to various of these officers for private communications and other help in this question, where the official reports failed, as they often do, to give required information :

Different Areas of Hindustan in the order of calculus prevalence.

AREA.	Proportion of Population eating rice.	Rates of calculus operations per mille of population.	Population in millions.	Average annual operations	REMARKS.
1 Punjab	$\frac{1}{19}$	·078	19	1,482	
2 N.-W. P. and Oudh ..	$\frac{1}{11}$	·021	45	925	
3 Bombay	$\frac{1}{8}$	·017	$16\frac{1}{2}$	283	
4 Central Provinces ..	$\frac{1}{3}$	·011	$9\frac{3}{4}$	112	
5 Bengal Proper ..	$\frac{2}{3}$	·0034	$69\frac{1}{2}$	218	Numbers heightened by Behar.
6 Madras ..	$\frac{1}{3}$	·00067	31	21	
7 Assam	$\frac{3}{4}$	Nil.	$4\frac{3}{4}$	Nil.	None known.

Total Annual Average Operations for all India 3,041

I. In British India, then, every year, no less than 3,041 calculi are removed from the bladders of natives, or rather 3,041 operations for the removal of as many (and more) " stones " are performed, and of this total nearly one-half occur in the Punjab.

II. The next point to note is that the order of calculus prevalence is in inverse ratio to the population eating rice as its staple food upon each area. If there seem to be even a slight flaw in this inverse relation, in the fact of Bengal Proper having a higher calculus ratio than Madras, with twice the amount of rice eaters (relatively) to that of the latter, this is only apparent, and is due to the inclusion of cases in Behar (a wheat and millet region) in the Bengal Proper statistics. If Behar were excluded and carried into the N. W. P., Bengal would take its proper place in the list below Madras, with a ratio per mille of ·0004.

III. Where practically the whole population lives on rice as its staple food, calculus disappears, as in Assam.

IV As we leave the coast areas, and mount ever higher above sea level towards the interior, calculus increases in prevalence. Though Bombay stands third on the list, its coast area is very limited, the rice eating population is small, and the calculus rate represents the high-lying millet region of the Deccan.

We place a double contrast in view in the above sketch—

(1) A contrast between the staple foods of certain defined areas.

(2) A contrast between the sea-coast and the interior.

What we here set ourselves to show is *that vesical calculus in India flows as a result of the factors involved in this double contrast.*

A very interesting battle drama is constantly going on in the upper layers of the soil—a fight between carbonic and silicic acids for possession of the bases, sodium and potassium, and the result is that the sea accumulates all the sodic chloride, while the soil inland is robbed of this salt, and contains little else than potassium salts (see Bunge.) [*] Now, the amount of Na Cl in any organism corresponds and varies with the amount in the environment. Na differs in this respect from K, which is an integral and indispensable part of every animal and vegetable cell All sea and land plants contain K, but many plants contain but the faintest traces of Na, and only sea-weeds and coast vegetation are rich in it. Any exceptions to the rule have probably migrated inland, and were originally indigenous to the sea-coast. Passing upwards in the scale of organised life, we find it precisely the same with invertebrates. Only sea forms and the allied forms on the coast areas contain such salt, while purely land invertebrates have very little salt in them. Land vertebrates are remarkably rich in salt in spite of the dearth around them, but we can account for this by remembering that the first vertebrates lived in the sea, and we humans owe our salt constituent to our genealogical connection. We have each one gone through the " chorda dorsalis " and " branchial arch " stages of our marine ancestors. The younger the vertebrates in their individual development the more salt (Na Cl) they possess, and the embryo of the mammal contains more than the new-born offspring. Cartilage, our tissue of greatest antiquity, contains more Na Cl than any other tissue, and thus dry land vertebrates have left their more normal environment near the sea, and far inland are now undergoing a process of adaptation to their less normal saltless surrounding. From these facts we deduce—

(I.) That inland populations are, to a certain extent, battling with an unfavorable environment as regards the absence of the necessary salt, in which they originally developed ; this also serves to explain the unconquerable desire which the great majority (see later) of people exhibit for salt in their food.

(II.) It explains the necessity for a liberal allowance of salt to children, our " embryological ancestors," if we may so call them, and the consequences of its deprivation will be the more apparent in pathological effects (see later). The offices which common salt performs include—

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[*] Physiolog. and Patholog. Chemistry.

(1) The construction of organs,

(2) It is the chief factor in the formation of gastric juice.

(3) It dissolves "globulins."

(4) The nitrogenous products of metabolism cannot be eliminated by the kidneys in the absence of chlorides. Now, in all food we take, there is always some amount of sodic chloride, and animal food contains far more than vegetable and cereal food, and we might at first think that on theoretical grounds there is no physiological necessity for extra quantities of salt to be taken beyond that incorporated in our food. But we notice that it is only herbivora that require these extra quantities; carnivora and all purely flesh-eating races not only despise but avoid it. Look at the Kamschatkales, the Eastern Finns, the hunting tribes of Northern Siberia, the "Todas" of the Neilghiris, the Kirghese, the bushman of South Africa, the shepherds and stockmen of the South American Pampas. All these are purely carnivorous races, or sections of races eating flesh solely and abundantly, and they do not understand the uses of salt, inasmuch as they have never needed it. Whereas we find that as a tribe emerges from the nomadic hunting state to that of agriculture, in a more or less fixed environment, the taste for salt arises imperatively and demands supply. The people eat less and less flesh, and more and more depend on the soil, on vegetable grains and products. We see ruminants seeking out places where rock salt is exposed, or salt pools. Why is this? First, there is far less salt in the food of herbivora and vegetarians than in flesh diet, but the great point is that the herbivora take in their food three or four times more of the salts of potassium than the carnivora. Now, a salt of potassium (say carbonate) meeting with common salt ($NaCl$) in solution in the body, an exchange takes place —KCl and Na_2Co_3 are formed (and here we may point out that Na_2Co_3 plus uric acid equals acid sodium urate). $NaCl$ is well known to be the chief inorganic constituent of the blood—plasma, and when K salts reach the blood, the above exchange takes place; the blood loses its invaluable $NaCl$, and a foreign constituent, *viz.*, Na_2Co_3 (sodic carbonate) is there in excess, replacing the necessary and normal $NaCl$. One result of this is that the blood is rendered alkaline, and uric acid is swept out of the economy (see later). The next result is brought about by the power the kindeys possess of eliminating all foreign constituents, and so maintaining the due standard; hence this sodium salt (Na_2Co_3) is eliminated together with the KCl (see above), and the net result is that $NaCl$ is withdrawn from the organism; that is (let us grasp the fact)—We start with less $NaCl$ in our food, if we are graminivora and vegetarians; this food contains excess of potash salt, and this, by the reactions described, withdraws even the diminished amount of salt consumed in the food from the economy, *i.e.*, as regards the salt ($NaCl$) less intake and far greater expenditure on purely vegetable diet. Let anyone try the simple experiment of cutting off his meat entirely and replacing it by extra amount of vegetable grain food; also let no extra salt ($NaCl$) be taken or, to make the demonstration plainer, let less salt than usual be taken with this purely vegetable diet, the urine will later be found alkaline, and chlorine and sodium are discovered in quite striking excess. Now we can appreciate the special necessity—the imperious demand of the economy in members of a graminivorous race like the natives of India for salt, and a large amount of extra salt in their diet. We remember how the Mosaic law enjoined the Jews to offer gifts of vegetable, fruits accompanied by salt, to their Deity; in Greek and Roman sacrifices animals were always sacrificed *without* salt to their gods. From the above facts, we see that at every period, in every part of the world, and in every climate, there are people who use, must have salt, and, also certain people who do not use it. The people who take salt, though differing in every other respect, are all characterised by a vegetable diet. In the same way, those who do not use any salt at all, are all alike in taking purely animal food. We have also seen that this urgent necessity for salt in vegetable diet depends upon the eliminating action of the excess potash salts, and if various food stuffs are compared in respect of this potash constituent, it will be found that the proportion of potassium to sodium is highest in the very food staples on which the vast bulk of the Indian population is supported, that is to say, highest in all the common Indian food stuffs, save RICE.

Look now for a moment at the diet of the natives of India. The cereals and leguminosæ are very rich in K, and hence much salt ($NaCl$) is required, if disturbance of normal metabolism is not to ensue. (It is found in France that the agricultural population consumes, man for man, three times the amount of common salt eaten by the Urban population).

But one important food-staple (vegetable) of India is very poor in K salts, *viz.*, rice. This contains six times less K than the cereals, wheat, barley and rye, and 10 to 20 times less than the leguminosæ, 30 times less than the potato. People therefore who live solely, or almost solely, on rice scarcely require salt at all as an extra, and in fact we find that the rice-races of India, and of some East Indian islands, and some Bedouin tribes on the Arabian Peninsula, have no desire for salt. (Bunge,* op-cit). Besides this rice is a low level coast food, where salt-fish and fruits are abundant.

Salt is then, as we see, absolutely essential in all other vegetable diets. Further, we draw attention to the fact that the milk of herbivora contains three times as much potassium salts as that of the human subject; hence those with whom the milk of herbivora is a prominent article of diet, along with cereal food—especially does this refer to children in this country—

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*"Ethnologischer Nachtrag Zur Abhandlung über die Bedeutung des Kochsalzes."

will suffer especially in their digestive reactions, if the supply of salt be insufficient.

Now, here it will be convenient to compare, in view of the foregoing facts, the diets which are considered the standards for physiological requirements for Europeans and natives in India, respectively. We venture to attach the "scales" in the actual form in which they stand in the "regulations," so that no question need arise as to the facts upon which we are basing important conclusions :

European Soldiers' Ration in India.

ARTICLE.	Weight.	Weight of Water.	Albuminates.	Fats.	Carbo-hydrates.	Salts.	Water-free Solids.
	Oz.	Oz.	oz.	Oz.	Oz.	Oz.	Oz.
Meat 1lb. (deduct 20% for bone) ..	12·8	9·6	1·92	1·075	....	0·204	3·2
Bread	16	6·4	1·28	0·24	7·87	0·208	9·6
Vegetables ..	16	11·84	0·024	0.016	3.744	0·16	4·16
Tea	0·7	....	....	....	....	.....	....
Sugar	2·5	0 075	....	....	2·41	0·012	2·425
Rice	4	0·4	0·2	0·032	3·328	0·02	3·6
Salt	1.25	....	....	....	....	1·25	1·25
TOTAL ...	53·25	28·315	3·424	1·363	17·352	1·854	24·235

Daily Food of Native Sepoy.

Attar, ground Wheat ...	24·0	3·36	3·504	0·288	16·464	0·384	20·64
Dal	4·0	0·6	0·88	0·08	2·12	0·096	3·4
Ghee	1·0	0·06	0·003	0·91	..	..	0·913
Salt	0·16	..	..	..	..	0·16	0·16
TOTAL ...	29·16	14·02	4·387	1·278	18·584	0·64	25·113

We note :—

I. The intrinsic dryness of the native diet.

II. The large excess of albuminates and carbohydrates; albuminates are in excess to an extent of one-fourth.

III. The extraordinarily diminished amount of salts, just one-third, in the native diet; and further, this decrease is almost solely in the common salt (Na Cl) ingredient—the very element that, on our facts, ought to be in excess.

Bearing this well in mind, we may now set down the results arising in the human economy from a diet exhibiting—

(*a*) Insufficient common salt (Na Cl),
(*b*) Excess of potassium salts,
(*c*) Excess of albuminates.

These results are :—

I. Specially with relation to deficiency of common salts, and to its excessive elimination by K. salts, a deficiency of the gastric juice, as to quantity, as to quality, of its HCl element, this leading to—

(1) General dyspepsia, aided also by excess of irritant K salts.

(2) Excessive accumulations of fermenting micro-organisms in the intestinal tract.* This taken along with the excess of albuminates in the food (see (*c*) above) induces important results to which we shall immediately refer, *viz.*—

(3) The production of aromatic sulphates, lactic, butyric and fatty acids of decomposition ; these giving rise to—

(4) Anæmia. Here I would say that owing to less oxygenation (due to there being less O. in a given bulk of air respired, and also to the inactive habits of the natives) the normal æration of the blood is interfered with, and hence anæmia. There is also increased sensible and insensible perspiration, and hence a concentration of the urine, with increased action of the liver, followed by torpidity, which, with a diet of high albuminous contents, will lead to lithæmia, or uricæmia ; an alkaline blood being a solvent of the urates. An alkaline blood containing uric salts is one great cause of anæmia (Haig.)

II. Non-solution of the globulins. In this connection we must remember that in mal-nutrition (so much more common, in reality, than starvation among natives, and especially among native children), the globulins go on to increase, while the albumin itself decreases. Hence globulins, in the absence or deficiency of Na Cl, the only solvent, go on to accumulate still more, and are in abundance to undergo decomposition by micro-organisms in the bowel as indicated above (1), (2) and (3). Albumoses are also formed in this way, and these are recognized as a source of "intestinal fever." (Ott.)

III. Alkaline bases are diminished, whose function is to neutralize uric and sulphuric acids in the economy, and hence one mode of formation of aromatic sulphates (see later). Now in connection with the excess of albuminates taken in with cereal and leguminous foods, and with the globulins, which form of proteid occurs so largely in vegetable grains, and which we have seen tend to accumulate in mal-nutrition, and in the absence of the solvent Na Cl, we have to remember that animal food is much more completely absorbed in the economy than vegetable. Proteid of meat completely disappears, proteid of milk reappears in the fæces, and still more proteid is unabsorbed from cereals and leguminosæ. Rubner "Zeitschrift f. Biologie," Vol. 15, p. 115, 1879, gives the following results of his experiments :—

Beef percentage of *unabsorbed* albumin ...	2·5 2·8
Milk " " " " ...	2·9 4·9
Maize " " " " ...	15·5
Dal and Bread " " " ...	12to 20

Now as a result of increase of proteids ingested, and then of their imperfect digestion in the stomach, with accumulation of globulins from mal-nutrition and non-solutions by the HCL element in the gastric juice, the door being opened for access of fermentative bacteria (N. Sieber, loc. cit.*) decompositions are set up in the intestine, and disintegration products from partially digested proteids are formed, *e.g.*, fatty acids (whence oxalic acid) ; and, as Hunter has shown, greatly increased formation of the aromatic sulphates, which go to neutralise the free acids of the urine. Hunter has proved that these aromatic sulphates, so abundant in the urine in anæmia, are derived from the sulphur of the proteids of the food, by the action of micro-organisms in the intestine under conditions of perverted and deficient gastro-intestinal absorption, such as we have pointed out ("B.M. Journal," Vol. I., p 44). The "phenols" formed in the bowel unite with the sulphuric acid, with dehydration ; the sulphuric acid is converted from a dibasic into a monobasic acid and reappears in the urine as an alkaline salt. Baumann first showed ("Pluger's Archiv.," Vol. 12, p 69, 1876) that the urine of herbivora always contains an abundance of phenol-sulphate of potassium ; this and other aromatic sulphates are only absent in the urine of those living exclusively on flesh diet. Now benzol and phenol, arising from the putrefaction of proteids in the intestine, can be made to increase by neutralising the antiseptic HCL. of the gastric juice, by deprivation of NaCl with a diet of cereals (Baumann) ; and there is a corresponding increase of the aromatic sulphates in the urine, going to neutralise free acid there. Now the most important acid constituent for us as regards calculus is the acid phosphate of soda, which has the power of holding both calcic oxalate and uric acid in solution, and anything which goes to neutralize this NaH_2Po_4 and render it alkaline Na_2HPO_4, will cause deposit of the calculus acids, and the question of which calculus acid is deposited will depend on other circumstances. The solution of oxalate of lime in the urine depends upon its acidity, and a solution of acid phosphate of soda dissolves it as we see, and we can thus explain how it is that oxalate calculi sometimes form under similar conditions as phosphatic calculi, and that very often vesical calculi consist of both ingredients, mixed up together, or in concentric layers. It also further accounts for another very frequent combination in India of uric acid and oxalate of lime in stone (see most recent reports of Cunningham and Gimlette, as regards their operations, "B.M. Journal," May 9th, 1891). We may here just remind ourselves that normal urine only becomes alkaline after a vegetable diet, containing the potash salts of combustible acids, and these are largely present in fruits and berries, which contain the acid potash, salts of tartaric, citric malie and other organic acids. After combustion of the acid, the K. appears as the carbonate, and then the urine gives a strong alkaline reaction. Potatoes also cause a strongly alkaline urine, because they contain little albumin, only two per cent., and therefore little sulphur and hence little sulphuric acid, but they hold much malate of potassium, which is converted into the carbonate in the system. Now the most important Indian diet stuffs, *i.e.*, the cereals and leguminosæ, *not* rice, yield urine which is as acid as that due to a meat diet, under normal conditions of digestion, because they are rich in albumin and phosphates and in calculus, the evil factors at work are, as we have shown,—(1) the great amount of albumin, and (2) the poverty of bases (due in great extent to deficiency of the common salt necessary, which are able to neutralize the uric and sulphuric acids formed from albumen.

One more point as regards the liability of children to calculus. The amount of kidney excretion per kilogramme of body weight is far greater in children than in adults. Parkes gives the following statement :—

	In children.	In male adults.	Excess in children per kilogramme.
Water ...	59 c.c.	23 c.c.	36 c.c.
Urea ...	·973 gram	·500 gram.	·473 gram.
Urea and Volatile Salt ...	·279 "	·151 "	·128 "
Chlorine ...	·308 "	·106 "	·202 "

Hence in children the amount of chlorine is three times greater than in adults (note also the excess of nitrogenous products), and hence the special necessity of extra NaCl, and the special liability to concretions in children. Again NaCl acts as absorbent, not only of crystalloids but of colloids, fibrin, mucin and albumin. Bence Jones first showed the solvent action of NaCl on urate of ammonium, and this is also the case with uric acid. One part of uric acid requires 8,000 parts of water to dissolve at the body temperature, whereas the addition of half per cent. of NaCl doubles its solubility, and two per cent. NaCl quadruples its solubility (Plowright). Perfectly healthy urine should show no appreciable deposit ; when it becomes concentrated (as it is liable to do in natives for reasons given), uric acid is thrown down as a urate. This may occur within the bladder and the presence of a solid body in any part of the urinary tract favours depositions greatly. Dr. Goodhart has put it on record that the specially farinaceous feeders among childern are those addicted to passing uric acid in abundance ("B. M. Journal," Aug. 1, 1891.)

Lastly Hirsch, in his great work on "Geographical and Historical Pathology," remarks "on the mystery of the excessive prevalence of stone in the tropics," while "gout" is practically unknown. Now Dr. Haig, to whom I return thanks for much kindly personal help, has shown that the excretion of uric acid is greatly influenced by the comparative alkalinity or acidity of the blood, and that the amount of acidity may be made to vary within very considerable limits, by the kind of food, and by the process of digestion (as we have seen), as well as by the use of drugs. Uric acid in an acid blood tends to get stored in the spleen and joints, but when the blood is rendered alkaline (as we have seen it, by deficiency of $NaCl$, and excess of K), uric acid is dissolved out and excreted. We have then (1) greater tendency to formation of uric acid in natives, with excess of albuminates, and their deficient metabolism ; and (2) very complete elimination of this uric acid by alkaline blood (due primarily to deficiency of common salt) as far as the bladder. The obvious result is that gout must be a very rare disease among natives, because the alkaline blood stream never permits storage of the uric acid in the system or the joints.

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*Sieber : Journ. für "Prakt. Chemie," Vol. XIX., 1879.

Roberts, Croonian Lectures, 1892, draws attention to the effect of sleep and long daily fasts in increasing the amount of uric acid excreted, and these are assuredly factors in far greater play among natives in India with their fast from evening to mid-day and their somnolent habits than in Europe. The very common affection of enlarged spleen is another factor in the excessive excretion of uric acid. Pettenkofer found the normal average to be 0·872, while in a case of enlarged spleen it rose to 1·424 part in one thousand. A case of a boy of 16 is recorded, who excreted 18·28 grains daily, while his normal average should be about 6 grains. We have then perhaps an excessive production of uric acid, by the factors at work just described, and certainly far more complete elimination of it from the body and tissues by the alkaline blood stream as far as the bladder. What then causes its deposition here ? I do not think we can at present detail with certainty the steps in the process, which are doubtless varying and complicated. One important factor, perhaps, is the neutralization of the acid sodium phosphate (the uric acid solvent) by the aromatic sulphates ; and we know that the alkaline bases are diminished which go to neutralize the sulphuric and uric acids.

My chief object to-day has been to draw attention to some important dietetic considerations underlying calculus formation in India. More intimate and sustained observation of the chemistry of the excreta may perhaps avail to clear up doubtful points, and piece the scattered fragments of our little knowledge, and I hope in a fuller paper to throw some light on this important problem.

DISCUSSION.

F. P. Maynard (Calcutta) considered an accurate knowledge of the method of causation of vesical calculus of the greatest importance. He presumed that Dr. Roberts, in his paper, referred to uric acid calculus, and referred to Sir William Roberts' "Croonian Lectures (1892)," to point out the three forms of uric acid salts, *viz.*, neutral-urates, acid-urates or bi-urates, and quadri-urates. Of these salts, the first does not exist in the human living body, while the quadri-urates occur as the familiar amorphous urinary deposit. In birds and serpents, they also form almost all the solid urinary excretion. Roberts regarded the amorphous urate of man as the physiological homologue of the entire renal activity of birds and serpents. In the process of the ascending evolution of the kidney, Nature solved the difficulty of solid urinary excretion in the mammal by substituting soluable urea for insoluble uric acid. Apparently the conversion was incomplete, as a small residuum of uric acid remains as amorphous urate. In this respect it is to be hoped that our evolution is not final, if this residuum be regarded as a vestigial feature of analogous nature as to the vermiform appendix and ductus arteriosus. From this point of view Indians possess this vestigial feature to a greater degree than Europeans.

The tendency of the quadri-urates to liberate uric acid is checked by the saline matters, chlorides, sulphates, in the urine, more especially by the potash than the soda salts. Urinary pigments possess the same inhibitive power to a less extent. To a diminution of salines and pigments a number of cases of calculus might be ascribed. Perhaps the turmeric and pigmented spices of rice-eaters might have something to do with their relative immunity from stone.

Other important factors in the causation of calculus were the proportion of uric acid in urine, the degree of acidity of urine, and the ingestion of food. Fasting decreased the quantity of urine and increased the acidity, while ingestion of food had the opposite effect. During sleep and long periods of fasting, uric acid tends to be precipitated. Perhaps the long hours of fasting between the two daily meals at morning and evening of natives of India might, therefore, be one cause of the great frequency of stone in India.

Roberts' and Plowright's experiments show that by the exhibition of salines, *e.g.*, table salt, excessive acidity of the urine was prevented, and large quantities of uric acid were eliminated. In this connection the immunity from stone of sailors fed on salted foods was mentioned. Mons. Ferret, in connection with the occurrence of cataract, found that this disease was common in places near salt marshes, *e.g.*, Digilha in Algeria, etc. In France cataract was common in rural districts where the people lived on salted foods. The more frequent use of potatoes as food in these districts seemed to be coincident with a diminution of cataract, due, according to Ferret, to the potash salts of the potato, abstracting the soda salts of the blood. Ferret attributed cataract to an excess of salt in the blood, while Roberts, it would appear, considered precipitation of uric acid to be due to deficiency of salt in the blood. This deficiency seemed to be induced by the potassium salts of the food of Indians displacing the soda salts of the blood. Were Ferret's view on cataract correct, one ought to find cataract rare where stone is common. This does not appear to be the case in India.

The President thanked Surgeon-Captain Roberts for his paper, and stated that, of all the various hypotheses on the causation of stone, the one discussed in the paper seemed by far the most reasonable and probable. He hoped that others (members) would make observations on the subject. He then summarised the position in relation to the operative treatment of stone, contrasting lithotomy and litholapaxy. He personally inclined to advocate the supra-pubic operation for lithotomy, while fully recognising the merits of the perineal method in certain cases. The details of the supra-pubic operations by two stages were also described.

RADICAL CURE OF INGUINAL HERNIA.

BY HENRY GALLAY,

Surgeon-Major of the Colonies, Pondicherry.

During the two years of my medical charge of Pondicherry I have performed thirty-eight operations for the radical cure of inguinal hernia. The number of patients was thirty-six, of which two were operated on both sides. There were thirty-one operations on the right side and seven on the left.

Complications.—Twelve times the radical cure has been complicated by the necessity of performing operations at the same time for other conditions, *viz.*, twice for removal of a cancerous testicle, twice for the radical cure of old hæmatoceles, and eight times for the radical cure of old and voluminous hydrocele.

Twice adhesions of the gut to the wall of the hernia sac were met with. The adhesions could not be separated. It was found necessary to reduce the intestine without separating it from the walls of the sac. Three times the cæcum had descended into the scrotum. Once the cæcum was accompanied by the upper part of the colon and a mass of congested epiploic fat. After removal this fat weighed 4lbs. Once the cæcum and ileo-cæcal valve were found in the hernial sac on the left side. On another occasion adhesions between the wall of the sac and a mass of fatty omentum three inches thick were found. Thus in thirty-six operations eighteen, or 50 per cent., were complicated.

Notwithstanding these complications, there were but four fatal cases, or 11 per cent., a result which bears favourable comparison with those of Banker, Bassini, Hucas, Championnier and other surgeons.

The fatal cases were :—

(1) One from tetanus. The local hospital, where the operations were performed, was formerly the home of tetanus. Of the 300 operations performed there during the last year this case was the first of tetanus. Perhaps it was as reasonable to accuse the flesh of the patient as the place of operation. The man was a cultivator. Perhaps the assistant in charge of antiseptic measures had not been sufficiently careful.

(2) On one occasion the sac was puckered up like a wart, the folds of which could not be unravelled. It was ligatured by two pieces of catgut crossing each other and then reduced. The thickness of fatty tissue was such that occlusion of a small artery was not complete. Slight effusion occurred on the right side of the iliac pit, the hernia being on the left. Fever set in and the patient succumbed with symptoms of peritonitis. At the *post-mortem* it was found that the neck of the sac which had been on the left side had gone after reduction over to the right, around it a little hæmorrhage had taken place, thus perhaps starting the peritonitis.

(3) One fatal case was owing to the prolonged suppuration in an old feeble patient, on whom the operations of radical cure of a right inguinal hernia and of a left old hydrocele were performed. Only a few drops of liquid were found round the line of suture on the right side. There was some infiltration of the underpart of the left side of the scrotum. The incision healed by first intention, but a piece of the lower part of the scrotum became gangrenous. The patient succumbed on the seventeenth day after operation from the effects of suppuration.

(4) This, the last fatal case, was that of an old man in whose scrotum the cæcum, together with the greater part of the large intestine and 4lbs. of congested appendices epiploicæ was found. The reduction of so large a mass, lying for a long time external to the abdominal cavity, was very painful. At the time reduction seemed successful, for twelve hours after the patient was quite comfortable. In the night rapid swelling of the abdomen set in. and death quickly ensued. No *post-mortem* was permitted. In my opinion death probably arose from volvulus after reduction. Twelve times the ideal result—union by first intention, removal of sutures on the eighth day, complete cure on the nineteenth day—was obtained. As a precaution patients were kept in bed till the thirteenth day when they left hospital.

Union has been delayed twenty times from tension of, or small accumulation of, fluid under the superficial sutures. In two cases, severe suppuration of the cord of the testicle supervened.

The general length of day in hospital was 45 days; two stayed 48 days, and two 53 days.

It is held that relapses after radical cure of hernias occur before the sixth month. Fourteen of the cases operated on have been seen after operation. The following list gives the length of time after operation :—

	Months.
19th December 1892 ...	...*i.e.*, 21
25th January 1893 ...	... 13
17th September 1893 ...	... 12
6th November 1893 ...	... 10
10th November 1893 ...	... 10
24th November 1893 ...	... 11
8th December 1893 ...	... 9
17th December 1893 ...	... 9
20th December 1893 ...	... 9
29th January 1894 ...	... 8
12th February 1894 ...	... 7
23rd February 1894 ...	... 7
23rd April 1894 ...	... 6
26th April 1894 ...	... 6

In all of these cases the cure was complete and maintained. In all the scar was soft and the spermatic cord free from adhesions. One, an old man æt. 61, had undergone excision of a cancerous testicle at the time of the operation for radical cure. He has regained his vigour and walked about strong and well. The next four cases were of sepoys ; of these one for thirteen months and the others for ten months, had performed their military duties satisfactorily. Three police peons, for ten, seven and seven months, respectively, had performed their patrol duties, being on their legs from six to eight hours daily.

One patient was operated on the 20th December. He left hospital to enlist as a sepoy. For ten months he had stood the strain of the military gymnastic exercises for recruits.

Two were cases of Europeans : one, a doctor on a steamer, has resumed duty for six months. He can go up and down the gangways and balances himself without difficulty while the vessel rolls and pitches. He does not wear a truss. The other case is that of a European tramp, who, ten months ago, was operated on for a hernia the size of an adult's head. He now continues his roving existence, walking to Cuddalore or Trichinopoly from Pondicherry without detriment. In all cases I made use of Bassini's process, which, as is well known, consists in the reconstitution by means of two whips with catgut of the two partitions of the inguinal canal in its full length, the deep orifice of the canal retaining just the width sufficient for the passage of the spermatic cord. The results I have obtained warrant me in holding a high opinion of the excellency of the method. It gives perfect stability to the reconstituted abdominal partition, allowing the inguinal canal to give passage to the spermatic cord, and yet by shutting the deep opening of the canal gives no opportunity for a relapse to occur.

The heavy work done and the strain endured by the fourteen cases narrated above confirm the conclusions which Bassini himself formulated : "That, as soon as the walls of the inguinal canal have been perfectly reconstituted by the operation for radical cure, the patient can be considered completely cured, fit for the arduous avocations of life, and not liable to rejection from the military services on account of bodily defect.

DISCUSSION.

D. N. P. Datta (Hushiarpur) instanced a case of left inguinal reducible hernia of long standing in a man, aged sixty, in which radical cure by Wood's method was performed. The sac, which was very large, sloughed. At the end of two months the patient was discharged cured.

A. Powell (Cachar) found it impossible to keep native patients sufficiently long in bed to ensure a successful result. His first case absconded on the fifth day of treatment. Although the wound healed by first intention, the hernia returned as bad as ever. He was of opinion that castration of the testicle on the same side as the hernia was absolutely necessary to obtain a successful result by complete closure of the inguinal canal. In one case thus operated on there were no symptoms of return of the hernia two years after operation. He pointed out that this special procedure was not to be of general application for all cases.

F. O'Kinealy (Calcutta) emphasised the same difficulty of keeping natives confined to bed during treatment after operation for radical cure, especially when healing by first intention occurred. He also pointed out the danger of infection of the wound leading to healing by second intention from the meddlesome habits of the native in removing the bandages and dressings. He advanced the opinion, although knowing that it might be considered heterodox, that union by second intention was preferable in unintelligent natives as it involved much longer confinement to bed, and secured a good firm scar. In cases where primary union occurred, it was found that, despite all hospital discipline, the patients often managed to get up out of their beds, and undo the bandages, and destroy the prospects of any good results.

R. D. Murray (Chittagong) congratulated Dr. Gallay on the success of his method of treatment, and felt that the best thanks of the members of the Congress were due to him for bringing the matter forward. He said that personally he had no experience of Bassini's operation, and was accustomed to adopt modification of Barker's and MacEwen's, in which he ligatured the neck of the sac very low down, so as to embrace a portion of the body. He then divided further up the large neck, and dealt with it as in MacEwen's operation. This plan was especially suitable for old hernia, which constitute the bulk of cases in mofussil practice. In these the sac is so voluminous and its adhesions so extensive that attempts to dissect it out completely are certain to be followed by sloughing of the scrotum and testicle.

CRANIAL SURGERY WITH SPECIAL REFERENCE TO FRACTURE OF THE SKULL AND THE USE OF THE TREPHINE.

BY R. D. MURRAY, M.B.,
Surgeon-Major, I. M. S.

In the short space of time allowed for the reading of this paper I fear I cannot do more than touch upon a branch of cranial surgery, as the whole subject is a very large and comprehensive one. Having, within the last few months, at the small Municipal Hospital at Chittagong, had several interesting cases of skull injury under my care, in all of which I trephined with successful results, it recurred to me that it might be useful to lay my experience in connection with them before the Congress.

I shall first narrate the cases as concisely as possible in their order of occurrence, and then add a few remarks on the points of special interest presented by each. In contrast to these four recent cases I give the notes of a fifth which occurred in the Chumparun Jail five years ago :—

I.—Simple comminuted depressed fracture with compression.

Hamed Ali, a cultivator, aged 18, was admitted to hospital at 7-30 P.M., on the 13th July. He had been hit in the head with a bamboo at 3 o'clock that afternoon, and was knocked down senseless. His temperature was 101° F., pulse 56, respiration rapid, irregular, gasping and loudly stertorous. Right pupil widely dilated and irresponsive to light. Epileptiform convulsions occurred every few minutes, most marked in the left arm and leg.

On examining the head a large contused swelling was found over the right parietal eminence, and around its edge the skull could be felt depressed into a hollow. The scalp was not wounded. As the man's condition was very critical, I at once determined to trephine as affording the only chance of saving his life.

The head having been shaved and cleansed thoroughly, the operation was begun without chloroform, the patient being already unconscious. A semilunar incision, five inches long, was made right down to the bone through the upper edge of the tumour. The scalp with pericranium having been reflected and a large subjacent clot turned out, an extensive depression in the skull was brought to view. The trephine was then applied at the upper edge of the fracture, so that a piece of sound skull was included. On removal of the disc of bone, another blood clot was exposed lying in the surface of the dura mater. With a gouge forceps about a square inch of comminuted bone was removed, the remaining portion of depressed skull was raised, and the coagulum cleared away as far as possible. The trephined portion of skull corresponded almost exactly with the motor area of the cerebrum, which could be seen pulsating through a rent in the dura mater made by a spicule from the inner table. Attempts to clear away the coagulum completely around and underneath the edge of the trephine opening caused rather profuse hæmorrhage, but this was soon stopped by steady pressure. The parts having been very carefully washed with bichloride lotion (1—1,000), and then freely dusted with iodoform, the flap was adjusted and stitched with silver wire, taking care to leave a drainage tube in. The usual antiseptic dressings were applied, and by the time the patient was back in bed the improvement in his condition was very remarkable. The breathing became slow, quiet and regular, 18 per minute, the previous restlessness disappeared, and the pulse rose to 60.

Progress—On the 15th the drainage tube was removed. On the 16th he became conscious and answered questions, but his expression was dull and speech thick and indistinct from partial paralysis of the soft palate. The muscular twitchings of the limbs continued. Right pupil nearly normal. 17*th*.—Photophobia of right eye with lachrymation, severe throbbing pain in the head. Ordered calomel and jalap purge and zinc lotion to the eye. 19*th*.—Pain in sternomastoids and stiffness of the jaws. Ordered chloral 20 grains every 4 hours. 20*th*.—Threatening of tetanus gone and intelligence improving, but memory very defective. 21*st*.—An ulcer has formed on the lower segment of the right cornea close to the periphery, and patient cannot close his left eye from paralysis of the orbicularis palpebræ. He complains of severe and constant headache. 23*rd*.—Expression brighter and articulation more distinct. He can now close his left eye. There is a ring of opacity round the corneal ulcer. Scalp wound absolutely healed by first intention and stitches removed. Ordered a mixture containing 5 grains iodide of potassium and 10 grains bromide of potassium thrice daily, and iodoform ointment to the eye.

From this period the patient's convalescence was uninterrupted and he was discharged on the 9th of August, his only complaint being defective vision. On examining his eyes with the ophthalmoscope distinct evidence of optic neuritis was found, being most pronounced in the right eye. He refused to stay any longer in hospital and was allowed to attend as an out-patient, taking the iodide and bromide mixture. The neuritis has gradually disappeared, and now, three months after the injury, the optic disc is almost normal.

The details of temperature, pulse and respirations are shewn in the accompanying chart.

II.—Compression of right motor area by blood clot with compound comminuted fracture of the outer table over the frontal sinus on the right side.

Mahomed Shashi, aged 32, a cultivator, was admitted, with the previous case, on the 13th July, in a comatose state, with a large diffused contusion over the right parietal eminence, and a contused wound three inches long on the right supraciliary ridge, with comminutions of the outer table of the skull. Left pupil dilated. Right pupil cannot be seen on account of the extreme swelling and tension of the eyelids. Breathing rapid and stertorous, 32 per minute. Pulse 60, temperature 100 F. Epileptiform convulsions with foaming at the mouth at intervals. He had vomited blood several times. There was complete paralysis of the left side of the face.

This man was a victim of the same riot as Hamed Ali, and, as in his case, the injuries were caused by *lathi* blows.

There was no laceration or wound of the scalp at the seat of injury over the right parietal eminence, and no fracture of the skull could be ascertained, but there was a very considerable extravasation of blood underneath the scalp. I diagnosed intracranial hæmorrhage, probably extra-dural, over the motor area, and proceeded to trephine. Curiously the affected area corresponded almost exactly with that in the first case. Without chloroform I made a similar crescentic incision about five inches long, and after reflecting the scalp with pericranium turned out the subjacent coagulum and exposed the skull. There was no fracture at this spot. I then applied the one-inch trephine, and on removing the disc of bone brought a pulsating blood clot into view. I then enlarged the opening with gauge forceps and removed as much as possible of the widely diffused coagulum. I did not open the dura mater. The meningeal surface was then freely dusted with iodoform and the flap brought into position with silver wire, leaving a drainage tube projecting from the most dependent part of the wound. The frontal wound was thus similarly attended to. After the operation the pulse rose to 72 and the respirations fell to 22, becoming quiet and regular.

Progress.—Recovery was uninterrupted. Both the scalp and supraciliary wounds healed by first intention, and the temperature, pulse and respiration soon became normal. Consciousness returned the day after the operation, and he talked quite rationally. There was a sharp rise of temperature to 101·8° on the 11th day, with severe headache, and again on the 12th day, but this, which looked like meningitis, setting in speedily yielded to phenacetin and did not recur. The dilatation of the left pupil disappeared on the third day, and the œdema of the right eye gradually subsided. There was congestion of the eye for about ten days, but the pupil was normal when first seen. The left facial paralysis had gone completely by the seventh day. There were occasional twitchings of the arms and legs from cerebral irritation during the first few days.

The patient was discharged with Hamed Ali on the 9th of August. There were no retinal sequelæ in his case.

III.—Compound comminuted depressed fracture without compression.

Rakimnesa, a Mahomedan female, aged 30, was admitted, with the above injury, on the 26th July 1894, several hours after it occurred. She had been struck on the head by her husband with an iron bar in a fit of homicidal mania, the man having immediately afterwards brained his mother-in-law and the village headman, who went to their rescue. The mother lived to be admitted to hospital and have her wound dressed, but died shortly afterwards. Her skull was shattered and the brain substance protruded.

Rakimnesa had a longitudinal contused wound, four inches long by half an inch wide, over the left parietal eminence. Free hæmorrhage had occurred. The skull corresponding to the scalp wound was fractured, comminuted and depressed. There was a contused vertical wound, one inch by a quarter of an inch at the junction of the hair and forehead in the middle line, through the pericranium, and involving the bone. The right eyelids were much ecchymosed and could with difficulty be opened. There was no unconsciousness or other sign of compression, although her expression was somewhat dull and stupid. Her temperature was 100, pulse 108, and respiration 32. Pupils normal, no muscular twitching and no paralysis. Considering the formidable nature of the head injury, the symptoms were wonderfully slight, but in view of the probable supervention of inflammatory mischief, I decided to trephine and elevate the broken fragments of skull.

The scalp having been shaved and cleansed and chloroform administered, a Y-shaped incision was made over the left parietal eminence, and the flaps with pericranium reflected. It was now found that the cracks in the skull were occupied by portions of hair, which had been forced through by the blow and were firmly locked. Under the circumstances septic inflammation was almost certain to follow if left alone, and my original intention to trephine had become all the more imperative. On removal of the crown of trephine, considerable extradural hæmorrhages was found to have occurred. I then with gouge forceps enlarged the opening downwards, and having extracted as much of the coagulum as possible, I raised the remaining portion of depressed skull, irrigated with bichloride lotion (1—1,000), applied iodoform and brought the edges of the wound together with silver wire. A drainage was left in as usual. The wound in the forehead was then attended to, and the whole put up antiseptically under a capelline bandage.

Progress.—There was slight pyrexia for about a fortnight as shewn by the chart, and a good deal of headache, but otherwise her recovery was uninterrupted. The scalp wound healed by first intention, and the stitches were removed on the eighth day: she had given birth to a child a month before admission, so that her breasts became swollen and painful (the child having been left at home), and no doubt this irritation was the main cause of her fever. She was very anæmic from loss of blood, and constitutionally weak after her recent confinement, so that she really stood the operations remarkably well. The forehead wound healed by granulation. After the stitches were removed, some pus collected under the pericranium and caused the wound to re-open. A small point over the trephine depression (at the junction of the limbs of the Y) gaped after withdrawing the stitches, and from the opening a small discharge of turbid serum continued to come for some time. She was discharged well on the 30th of August.

IV.—Compound comminuted depressed fracture with compression.

Hassan Ali, a fisherman, aged 36, was admitted at 8 A.M. on the 11th October, in an unconscious condition, with the above injury. He was struck in the head with a bamboo on the 9th and fell senseless. He lay flat on his back with the right hip and knee flexed, the right arm bent over his face, and the left arm and leg paralysed. There was also left facial paralysis. Right pupil widely dilated. Patient very boisterous and resisting all attempts to hold him down. Eyelids closed, the right contused. Temperature 98·4, pulse 50, full and resisting, respirations 17, quiet and easy.

On examining the head he was found to have a contused wound over the right parietal eminence, 1½in. long by ⅛in. wide, with swelling around it. A portion of the skull, the size of a rupee, underneath the wound, was depressed. The scalp generally was pulpy and boggy, and the left eye contused and discoloured.

The symptoms of compression over the right motor area being very marked, I decided to trephine at the seat of injury. The patient, although unconscious, was very restless, especially under peripheral irritation, and had to be chloroformed. The operation was performed as in the previous cases. Free hæmorrhage took place from the swollen and congested scalp and was controlled by Wells' forceps. On exposing the bone, blood was seen to ooze out from the interior of the skull, and on removal of the disc of bone there was copious hæmorrhage, but no bleeding point could be detected. The opening was enlarged with a view to try and catch the middle meningeal artery, but without avail. Pessure was tried, but without success, as the blood welled up rapidly and soaked the compresses. There was no clot and no pulsation. The subdural space was distended, and on opening the membrane, fluid blood in alarming quantity came pouring out of the wound. By this time the patient had almost bled to death and I was obliged to conclude the operations as quickly as possible. On replacing the scalp flat and stitching the wound, I was gratified to find that the hæmorrhage almost ceased. A drainage tube was inserted and the usual dressing applied. One hypodermic injection of ether was given during, and another at the close of, the operation. A stimulating, nutrient enema of beef-tea and brandy was also administered. The pulse was 140 and very compressable.

Progress.—4 P.M., temperature 99·4, pulse 140, respirations 28, dressings soaked and changed. 8 P.M., pulse 72, full and regular. Dilatation of right pupil less.

October 13th.—Answers questions, œdema of scalp gone, pupils equal.

October 14th.—Improving. Paralysis passing off. Facial paralysis scarcely perceptible. Quite conscious and rational.

October 17th.—Wound perfectly healed, doing well.

October 21st.—Intelligent and cheerful, is able to walk about.

October 29th.—Quite well and fit for discharge. He is naturally weak and anæmic after the severe loss of blood, and only requires time and tonics for his complete recovery.

V.—Simple depressed fracture not trephined. Death four months afterwards.

Kashi Dusadh, aged 45, was admitted for burglary to the Champarun jail, on the 29th June 1889, in a very prostrated condition, the result of a severe beating. His face and head were much swollen, the features being beyond recognition. The pupils could not be seen. There was no paralysis. He made a good recovery and was discharged from hospital on the 18th July. On the 28th July he went to Court to stand his trial on a charge of house-breaking, was convicted and sentenced to two years' rigorous imprisonment. On the 4th of August he was admitted to hospital for rheumatism and was discharged on the 27th September. He was re-admitted for fever and pain in the throat on the 29th September. At 9 P.M., on the 30th October, he was suddenly seized with convulsion, his temperature ran up to 105° and he died at 4 A.M. on the 31st.

From his first admission to jail he never had any nervous symptoms beyond some slight defect of vision. He never had paralysis of any kind, and there was an entire absence of head symptoms. Yet this was the condition found on *post-mortem* examination. A large slightly depressed stellate fracture over the centre of the right parietal bone, firmly united and indenting the subjacent brain. There was purulent effusion into the arachnoid cavity both over the vertex and base. On the under surface, at the junction of the left frontal and temporo-sphenoidal lobes, a small superficial abscess cavity was found, with ragged margins, containing pus and debris. The surrounding brain substance was red and rusty looking. The cavity communicated with the arachnoid by a small opening, where it ruptured. The sequence of events in this case was :—

1. Fracture of skull, right side.
2. Hæmorrhagic effusion on opposite side.
3. Suppurative degeneration of clot.
4. Rupture of abscess.
5. Perforative meningitis.
6. Death.

Remarks.—All surgeons are agreed that, in cases of fracture with compression, the skull should be at once trephined, as the operation affords the patient the only chance of life. In cases of compound fracture, even where there is no compression, the early use of the trephine is advocated, not so much with the object of raising any depressed fragments as in order to cleanse the wound and prevent septic mischief supervening. No. III is a case in point. There were no symptoms of compression, but operative measures were rendered necessary by the impaction of hairs between the cracks in the skull.

In case II, where there was a compound facture of the outer table over the right frontal sinuses, the more serious injury was indicated over the right motor area, at which spot the scalp was swollen and bruised. The left facial paralysis and muscular twitchings of the left upper and lower extremities pointed to compression and irritation around the fissure of Rolando, and on trephining there a large coagulum was found and removed. Although therefore there was a compound fracture of the skull in this case, the trephine operation was undertaken for compression due to coagulum underneath the vault, and not to depressed bone.

In all five cases the parietal eminence was the seat of chief injury, and curiously enough in all, except the female who was attacked by a madman, it was the right side that was struck, indicating that the blows were probably inflicted from behind. Facial paralysis on the opposite side to the lesion was present in cases I, II and IV, while in IV only was there actual hemiplegia. Convulsive twitchings of the extremities were most marked in case I, and on the side opposite to the fracture. The pupil was widely dilated on the side of the injury in cases I and IV, and probably also in case II, but it could not be seen on account of the great swelling of the eyelids. In case I, the palatal muscles were involved as indicated by the imperfect articulation, and a corneal ulcer formed from failure of nutrition owing probably to pressure on the third nerve at the sphenoidal fissure. The dura mater was divided in cases I and IV, but not in the others. In case IV only was there serious hæmorrhage, and here it was truly alarming and did not stop until the stitches were being put in. The patient lost about 2lbs. of blood and I scarcely looked for his recovery. The scalp wound healed by first intention in all the operations. I believe iodoform to be a most valuable antiseptic in these cases. Coma and stertor were most pronounced in the first two cases and gave way at once to quiet, natural breathing after the operation.

I did not try MacEwan's plan of filling up the trephine hole with fragments of chopped bone from the removed disc, but mean to do so in the next opportunity. It might be better still to replace the entire disc of bone in the opening, a proceeding which has been followed with success. It is questionable, however, if MacEwan's recommendation is not more scientific, as it secures a continuance of the safety-valve action, whereas by plugging the opening with the crown of trephine, there is a danger of compression recurring from coagulation repriming underneath and free escape not being permitted for drainage. Even when the opening is allowed to remain with nothing but scalp and pericranium as a covering, it is wonderful how hard the tissues become after a time. In two of my cases, II and IV, it would seem as if bone was reproduced, for six weeks after the operation no opening could be felt, on making firm pressure, and the parts were firm and resisting as if ossification was in progress.

The sudden improvement in the condition of the patients after the operation was very striking, and, considering the highly favourable termination of the cases, I would advocate trephining in all cases of compound fracture, as well as in simple depressed fracture and other injuries followed by compression. By its safety-valve action it affords relief to intracranial pressure from whatever cause arising, and the moderate hæmorrhage which usually follows is salutary, inasmuch as it checks the liability to inflammatory consequences. The operation is not in itself a dangerous one. Case V is one of peculiar interest, and one is inclined to think that if the man had been trephined, his life would have been saved. The removal of pressure might have prevented the formation of the hæmorrhagic effusion which ultimately degenerated into an abscess and bursting caused fatal meningitis.

DISCUSSION.

Behari Lal Chakrabarti (Calcutta) related two cases of cranial injury. In one the bone of the right parietal eminence was sliced away by an axe-cut, exposing the dura mater over an area of a square inch. Under dressings of carbolic oil, the patient recovered. The other case was one of compound, comminuted, depressed fracture of the right parietal eminence, with pressure symptoms. After trephining, recovery was complete.

D. N. P. Dutta (Hushiarpur) mentioned a case of severe compound comminuted depressed fracture of the right parietal eminence, with wound of the brain, which did uninterruptedly well.

W. D. Carleton (Sabathu) mentioned a case of comminuted fracture of the frontal bone with unconsciousness. Several pieces of bone were removed and the wound healed, and the patient recovered, with a cicatrix five inches long. Operative treatment for recurring epileptiform attacks, which developed about five months after the original injury, was refused. In a second case of similar injury, followed by unconsciousness, elevation and removal of fragments restored the patient. In this case epileptiform attacks developed a month after the original injury. A portion of the cicatrix was removed and the epileptic attacks ceased.

R. Bird (Calcutta) called attention to abscess of the frontal lobe of the brain after compound fractures of the left supraorbital region, accompanied by symptoms of compression. Three cases of such compound comminuted fractures were briefly described, in each of which operation led to apparent recovery. After an interval, obscure head symptoms, accompanied with anosmia, developed. In one case by operation an abscess in the frontal lobe was opened, but the patient died of septic meningitis. In two other cases with the same symptoms, and optic neuritis, operation was refused Coma developed suddenly without warning, followed by death in a few hours. These abscesses were considered to be due to sepsis, the fractures being trebly compound, if the line of fracture radiates from the frontal sinus across the horizontal plate of the frontal bone into the ethmoid.

Tarleton Young (Umballa) considered that the best trephine was one driven by a small dynamo Its management was easy, and its accuracy was very satisfactory. He was in favour of immediate trephining in compound depressed fracture of the skull, only if there are definite symptoms of cerebral mischief. He instanced a case of compound depressed fracture of the left parietal eminence, with protrusion of brain substance, in a child aged six. The protruding brain was removed and the patient recovered without a bad symptom.

A. Buist Sparks (Calcutta) related a case of a man who was brought seventy miles by the police with an untreated, absolutely stinking, compound depressed fracture of the right frontal region. He had *no* symptoms referable to head injury. Two days later, when the wound had become sweet, the depressed fragment was removed by trephining. The wound healed promptly A month after the patient, previously quite well, was found lying moribund with paresis of all his limbs.

Cusins (Calcutta) thought it absolutely wrong to trephine in cases of skull injury in the absence of definite symptoms of compression. He related the case of a child, æt. 6, who had walked to the hospital, had fallen from a roof. She had sustained a punctured wound of the scalp and skull, from which undoubted cerebral matter was oozing. The child's mother refused to allow the patient to be treated other than as an out-door patient. No brain symptoms appeared at any time, and the child made a perfect recovery.

Another case of fracture of the petrous bone in a medical officer, who met with a fall while riding, was related. The point of interest being that the patient owed his life to the very free oozig of blood from the ear, which prevented accumulation of blood and consequent cerebral compression.

Peck (Mozufferpur) thought that the lower the brain development of the patient, the better the chance of recovery, other things being equal. A case of most extensive cranial injury with recovery was related in connection with the opinion stated.

Murray (Chittagong), in replying to a question on his method of dressing head cases, laid stress on the necessity of powdering the surface of the wound moderately before closing it with sutures.

LIGATURE OF THE INNOMINATE ARTERY.

BY J. LEWTAS, M.D.,
Surgeon-Major, I. M. S.

As instances of ligature of the innominate artery are of rare occurrence, and their results discouraging, I would venture to occupy the time of this section for a few minutes with the history of a case which had a favourable termination. A young man, twenty years of age, was brought to the Mardan Hospital on the 13th May 1889, with the following history: His gun had burst about a month before and a piece of the breech had, he thought, lodged in his neck just above the right clavicle. For the first three weeks after the injury, although the wound did not heal, beyond a feeling of pain and stiffness in the neck and shoulder, it did not cause him much inconvenience; but three days before admission a swelling had begun to appear above the clavicle, and blood of a brownish colour to ooze from the wound.

The following was his state on admission: He lay on his back with his head and right shoulder drawn together, and complained of acute pain in the right side of his neck. There was a partly healed wound, one inch in length, immediately above the clavicle, in front of the attachment of the Sterno-mastoid muscle: blood of a prune-juice colour was slowly oozing from this wound. The outline of the right clavicle was obscured by a swelling as large as a cricket-ball, which occupied the posterior triangle of the neck from the Trapezius to the Sterno-mastoid. This swelling was hard, and did not pulsate. Unfortunately I did not examine for a bruit, as I had no suspicion that the tumor was caused by blood extravasated from a wounded artery. As the man and his friends were anxious that I should search for the foreign body which they were convinced had lodged in his neck, and as I was then of opinion that I had to deal with an abscess beneath the deep cervical fascia, I introduced a probe into the original wound, but failed to detect any foreign substance. I then enlarged the original wound sufficiently to admit my index finger, and on passing this into the root of the neck I felt a hard substance, which, on removal with a pair of dressing forceps, proved to be a flat piece of steel, such as would cover the breech of a single-barrelled gun, and which weighed three drachms. On withdrawing the finger there was an alarming rush of blood from the wound, the cavity of which refilled in an instant when sponged out with absorbent wool. I made repeated attempts to see the bleeding point, but the flow of blood was so profuse as to make this impossible. Some idea of the extent of the hæmorrhage may be formed when I say that the column of blood which was thrown up from the bottom of the cavity was as thick as my little finger. Fortunately, on examining with the finger, I felt an opening in the subclavian artery behind the Scalenus Anticus muscle, and all bleeding stopped on making pressure at this spot. The man's condition was now desperate. He was pale and so absolutely unconscious from loss of blood that it was unnecessary to give any chloroform. Any attempt to tie the artery at the seat of injury behind the Scalenus muscle was out of the question, as there would not have been room for the necessary manipulations when the wound was occupied by my assistant's finger pressing upon the artery. An attempt to seize the artery with a Spencer Well's forceps, guided by touch alone, failed, as other structures also became engaged within the forceps. There was not time for much deliberation, and I decided to tie the common carotid and innominate arteries, beginning with the former, as it would guide me to the position of the latter. Confiding, therefore, the control of the artery to an assistant, I made an incision, two inches in length, along the inner border of the lower end of the Sterno-mastoid muscle, divided to a very slight extent the outer borders of the Sterno-hyoid and Sterno-thyroid muscles, and passed a carbolised catgut ligature (No. 2, of Macfarlane's make) round the common carotid artery, tied it and left the ends uncut for a few moments, in order that, by gently drawing upon them, I might be guided to the position of the innominate. This I cleaned with a director just before its bifurcation, and by means of a couple of blunt hooks freed it from its surroundings, and tied it with carbolised catgut. As the patient now seemed to be *in articulo mortis*, in order to avoid the odium which inevitably attaches to a death on the operation table, I applied a piece of gauze dipped in carbolic lotion over the incision, and had him hurriedly transferred to his bed and removed from the room without waiting to close and dress the wound. I explained to his friends the hopeless character of the case, feeling convinced that, as I spoke, he was either dead or dying. But although for several hours he remained unconscious, owing perhaps in part to temporary interference with the cerebral circulation, as well as to loss of blood, at the end of that time he became conscious again, and I completed the dressing of the incision I had made by washing it with carbolic lotion, completely closing it by sutures, and finally covering it with a pad of sal alembroth wool. The large cavity in the posterior triangle was plugged with a long strip of boric lint wrung out of carbolic lotion, partly because there was slight hæmorrhage from it then, but chiefly as a preventive measure. In the course of the next few days, as this plug became loosened, it was gradually removed by cutting off a piece of it daily; and when the whole of it had been taken out a small drainage tube was inserted in the cavity, as the discharge from this had an offensive smell. At the end of another week this tube was removed, when the cavity gradually closed. The incision on the inner side of the Sterno-mastoid healed by primary union. There was no secondary hæmorrhage. The patient had a long convalescence, owing, no doubt, to the weakness and anæmia which resulted from the hæmorrhage: hence he was not discharged until forty-three days after the operation. When he left the hospital he still carried his right hand in a sling; no pulsation could be felt at the wrist, but there was a feeble pulse in the brachial artery. I asked him to show himself again after a month. However he did not do so for six months, at the end of which he presented himself at the hospital carrying a basket of melons on his head,—a present for the patients. He was then in perfect health, earning his living as a field-labourer, and he assured me that his right arm was as strong and useful as his left.

It only remains to add a few words respecting the operation. I did not find it necessary to divide the Sterno-mastoid muscle at all, while of the Sterno-hyoid and Sterno-thyroid muscles, only the outer edges were divided to the extent of perhaps one-eighth of an inch. This, I think, was favourable to healing by primary union, as no cavity was left, such as results on the retraction of divided muscles.

The following passage occurs in an excellent paper on this subject which appeared in the *British Medical Journal* of 13th July 1889: "Mott's incision has been followed more or less closely in nearly all the operations; and the insertion of the sternal muscles into the sternum and the inner part of the clavicle have been divided to a greater or less degree. The divided muscles retract, and they leave a cavity when the skin is closed, since it is impossible to keep in apposition the deeper surfaces of the wound by pressure. This fills with blood-clot, and from the cut ends of the muscles much oozing takes place. The records of the cases show how easily the blood-clot breaks down when a sinus has been kept open too long by the constant drainage of discharge from the edges of the cut muscles. In this way septic changes gain access to the ligature. Therefore the great necessity appears to be that the ligature should be completely buried by immediate union of the depths of the wound."

As the common carotid must be tied at some stage of the operation, by tying it first the operator is enabled to make use of this artery as a guide to the innominate, and by keeping very close to the latter and tying it near to its bifurcation, there is little risk of injury to the pleura and the other structures in the neighbourhood. The innominate has also been reached by two other methods of operation: In one by removal of the upper part of the sternum and inner end of the clavicle; in the other by a median incision like that for tracheotomy; but I am unable to see that either of these operations is preferable to the one usually adopted, *viz.*, in the angle between the Sterno-mastoid and Sterno-hyoid muscles.

The ligature must be aseptic. I made use of carbolised catgut, of about the thickness of whipcord, because that was ready, but perhaps a silk ligature would be safer, since, in addition to being aseptic, it is not likely to undergo a too rapid absorption or solution.

Of the seventeen cases tabulated in Erichsen's Surgery all, with one exception, were cases of aneurism, and many of the fatal results were, no doubt, due to a diseased condition of the innominate artery itself. This report shows, I think, that in a young healthy subject, the innominate artery may be safely ligatured in a case of wound of the second part of the subclavian artery.

HYPERTROPHY OF THE ADENOID TISSUE IN THE NASO-PHARYNX: AN ANALYSIS OF ONE HUNDRED CASES.

BY F. O'KINEALY,
Surgeon-Captain, I. M. S.

THE subject of hypertrophy of the adenoid tissue in the naso-pharynx has been before the medical profession for many years. In this country it has recently been brought forward, notably in papers, in the *Indian Medical Gazette* for 1892 and 1893. And the comment has been made that in India this condition does not appear to have received the attention which it deserves.

In the following paper an attempt will be made by an analysis of one hundred cases to ascertain the race distribution, age, incidence, ratio for sexes, and the frequency and nature of the complications of this condition, and to point out, if possible, any facts that may prove of interest.

Naturally the inferences to be drawn from so small a number of cases must be received with the reservation that they are but approximate in nature. Moreover the records of the examination of each individual patient have occasionally not been as complete as might be desired, but in extenuation of this is urged the difficulty of making very accurate observations amidst the press of work that hospital out-patient practice entails.

The one hundred cases occurred amongst a total of 461 patients of various nationalities, who were treated for affections of the nose and throat in the surgical out-patient department of the Medical College Hospital, Calcutta, between February 9th and December 17th of this year—a period of a little over ten months. It will thus be seen that this condition was found to be present in 23·8 per cent. of all the patients treated, showing that it is not uncommon in this city.

The term hypertrophy of the adenoid tissue in the naso-pharynx has been made use of, because it appears to more accurately define the pathology of a condition which has been shown to be a simple hypertrophy of the lymphoid tissue normally existing in this region. Moreover, amongst the patients examined, it has been found in degrees varying from that in which the individual lymphoid follicles on the posterior wall of the naso-pharynx are enlarged, as in granular pharyngitis, to that in which both they and the pharyngeal tonsil are so hypertrophied that the naso-pharyngeal space is almost filled by a mass of adenoid tissue. At the same time the condition most commonly met with was that in which the enlargement took the form of the cushion-like swelling of Lushka's tonsil described in text-books. Among the younger patients the symptoms met with in most cases were those typical of adenoid vegetations, while in the older they were chiefly those of naso-pharyngeal catarrh with its accompanying evils and discomforts. In some cases other diseases co-existed, which had no definite connection with the hypertrophy; for instance, two patients were lepers and in a third there was paralysis of the left vocal cord with concomitant paralysis of the left side of the soft palate,—a condition obviously referable to nerve trouble.

Race.—Calcutta is so cosmopolitan a city that, with the few figures at disposal, it would not only be a matter of difficulty, but one of no apparent practical value to consider the various nationalities separately, and the cases have, therefore, for purposes of comparison, been divided into two main groups, *viz.*, Europeans and natives. Under the former heading are classed natives of Europe, Eurasians, Jews and Armenians, the great majority of whom have been born and bred in India, while the latter group includes Hindoos, Mohammedans and Native Christians, no matter from what part of the country they may have come. Of 461 patients then 171 or 37 per cent. were Europeans, and the remaining 290 or 63 per cent. Natives. Amongst these 61 or 35·6 per cent. of the Europeans and 39 or 13·4 per cent. of the natives were found to be affected with the conditions under consideration—a percentage, as has already been mentioned, of 23·8 of the whole number examined. It would thus appear that for each native in whom this condition was found to exist, the proportional number of Europeans who suffered from the same complaint was over 2½. Why this should be so is not quite clear. It is a question whether it may not be due, in some measure, to the different modes of life of the two peoples, or to the fact that, as in the cases examined, fewer children and young adults came under treatment among the natives than among the Europeans. Table I, herewith appended, would appear to lend some support to the latter hypothesis ; for, on referring to it, it is seen that, of the patients examined, the proportion of those who were under twenty years of age is markedly less where natives are concerned than it is with Europeans, *viz*., 54 out of 290 or 18·6 per cent. of the former, as against 75 out of 171 or 44 per cent. of the latter.

It is acknowledged in Europe that this condition is very common amongst the Jews, and although of all the patients examined only 11 were of this race, a number so small as to be obviously of no value for arriving at any conclusion, yet it is, perhaps, worth remarking that out of the 11 cases, 6 were affected.

Age.—The disease is admittedly one of youth, and this is well borne out by the figures in Table I. A reference to this table shows that amongst the Europeans 52, and in the case of the natives 21 of the affected patients were under 20 years of age, or a total of 73 per cent. The remaining nine Europeans, and eighteen natives, or 27 per cent of the total thus diseased were twenty years old or more Although for this latter period of life the actual number of natives in whom the condition occurred is greater than that of the Europeans, still on comparison with the numbers examined, for the same period, the percentage in the former race is found to be 7·6 as against 9·3 in the latter. If the cases under twenty be similarly analysed, it is seen that 38·8 per cent. of natives and 69·3 per cent. of Europeans were affected—a ratio of one of the former to about 1¾ of the latter, which is distinctly lower than that obtained when the peoples are compared without taking into consideration the question of age. The youngest patient in whom this condition of hypertrophy was found was, in each race, 3½ years old, while the eldest was, among the Europeans, 31, and, in the natives, 35 years of age. Among these cases the lowest and highest age limits for the two sexes were respectively found to be as follows: -European males, 4 and 31 years. European females, 3½ and 21 years. Native males, 3½ and 32 years. Native females' 8 and 35 years.

Sex.—The disease was found amongst the Europeans in 41 out of 124 males and in 20 out of 47 females, while amongst the natives it existed in 30 out of 239 of the former, and in 9 out of 51 of the latter sex (*vide* Table I). The cases at disposal seem, therefore, to show a preponderance of the male element. If, however, the relative proportion of patients affected to those examined be considered separately for each sex, it would appear that the females are more prone to the complaint. Thus, among the Europeans, about half the females and a third of the males suffered, while in the natives, approximately, a sixth of the former and an eighth of the latter sex bore evidences of this condition, or, roughly speaking, a quarter of the women and a fifth of the men of both races.

Complications.—Under this head it is proposed to include those affections of the fauces, pharynx, nose, larynx, ears and tongue found in the one hundred cases, which would appear to have some bearing on the adenoid hypertrophy. The figures in the connection are given in Table II.

Fauces—Faucial troubles were found in 73 patients, 47 Europeans and 26 natives. The sex distribution being 32 males and 15 females in the former race, and 20 men and 6 women in the latter. In all but two of these cases, either one or both of the faucial tonsils were enlarged, while in many of them there was congestion and hypertrophy of the faucial pillars, more especially of the posterior ones.

Pharynx.—This was affected in 71 cases : 44 being Europeans, of whom 28 were men and 16 women ; and 27 natives, comprising 22 of the former and 5 of the latter sex. The condition found in 66 of them was that of granular pharyngitis, the posterior wall of the pharynx being either dry, or simply congested in the remaining five.

Nose.—Nasal affections were noted in 60 cases, of whom the Europeans numbered 32, including 19 males and 13 females, while the remaining 28 were natives, and comprised 22 men and 6 women. Thirty-one Europeans and 23 natives suffered in a greater or less degree either from hypertrophic rhinitis, deviations of the septum or cartilaginous outgrowths therefrom, such as crests and spurs ; these conditions being found both singly and in various combinations. One European had necrosis of the septum, and among the natives slight ulceration of the nostrils was seen in four cases, two patients suffered from so-called "nasa fever," nasal polypi occurred in one case and papilloma of the nose in another.

Larynx.—Although the larynx was not examined in every case, it was found to be in various stages of chronic congestion in 21 patients. Of these 8 were Europeans and all males ; the natives numbering 13, of whom 11 were men, and the remaining 2 women. One of these last was the case of paralysis of the vocal cord and soft palate on the left side, of which mention was made in the earlier part of this paper.

Ears.—These organs were only examined when any complaint was made regarding them, and the number of cases noted is comparatively small in consequence. Records of ear trouble are found in 22 cases, the Europeans comprising 14 with 9 men and 5 women; and the natives 8, including 6 of the former and 2 of the latter. The condition met with was chiefly that of middle ear and Eustachian catarrh. In several cases perforation of one or both drum membranes had taken place, and in one instance, that of a native male, aged 21, there was such complete destruction of this structure and of the interior of middle ear on the right side, that the orifice of the Eustachian tube was not only clearly visible, but the end of a probe could be passed into it through the external auditory canal.

Tongue.—In this organ the conditions noted were hyperplasia of the lingual tonsil and enlargement of the superficial veins at the root of the tongue. These affections were found to exist in varying degrees, either separately or together, in 26 patients, of whom 9 males and 6 females, or a total of 15, were Europeans, and the remainder, 11 in number, consisting of 9 men and 2 women, were natives.

It will, therefore, be seen from the figures above quoted that, with one exception, in the cases of adenoid hypertrophy under consideration, the European race and the male sex actually show the greatest number of patients affected with each complication. The single exception being found under the head of laryngeal troubles when native males are in excess (*vide* Table II). Relatively, however, the numbers point to a prevalence of affections of the fauces, pharynx and ears, among Europeans and those of the nose, larynx, and tongue in natives. On the other hand, faucial and laryngeal complaints seem to be proportionately more common in the men of both races, while complications in the pharynx, nose, ears and tongue would appear to occur with greater frequency among patients of the opposite sex (*c.f.*, Tables I and II). It may here be added that these comparisons have been put forward merely for what they are worth, in the present instance, as it is felt that the figures from which they are drawn are too few for the purpose of formulating any general conclusions.

Treatment.—In those cases, chiefly adults, in whom the enlargement was either small in amount or did not give rise to other troubles, and in whom, therefore, operative interference was not called for, the usual methods of local medication were adopted, with the addition of constitutional treatment when necessary. If, however, it was considered necessary or advisable to remove the hypertrophied tissue, this was effected as thoroughly as possible, in order to obviate any chance of recurrence. For this purpose in nearly all the younger and in many of the older patients, more especially where the condition was marked, general anæsthesia was induced always by means of chloroform. In some cases, chiefly adults, a 20 per cent. solution of cocain was applied locally by means of a swab passed into the naso-pharynx, while in a few patients, in whom the growths were small, soft and few in number, no anæsthetic was given. The position adopted for the patients when under chloroform was that advocated by Mr. Butlin (*Lancet*, Vol. I., 1893, p. 363), in which the person to be operated on is ' placed on the side with the thighs flexed and the head a little forward on a low pillow." The various other positions advocated have been tried, but have been abandoned in favour of this one, which has the advantages of giving rise to less hæmorrhage and of allowing the blood to run into the cheek, whence it can easily be removed by means of sponges with the least amount of interference to the operator. The danger of blood running into the larynx does not appear to be enhanced in this position, and is reduced to a minimum if the anæsthesia induced falls just short of abolishing the laryngeal reflexes, as was done in the present cases. When chloroform was not given, the operation was performed with the patient in a chair, the head being slightly flexed and thrown forward. Whenever possible the whole of the hypertrophied tissue, together with the tonsils, if enlarged, was removed at one sitting. For this purpose the instruments used in the naso-pharynx either were a modification of Löwenberg's forceps or Gottstein's curette, the operation being invariably completed with the finger nail, while for the excision of the tonsils, Mackenzie's tonsillotome was employed, and the removal effected under the guidance of the finger, when the patient was under chloroform. When the growths were large and numerous, or of a firm consistency, they were removed with the forceps and the operation completed by scraping first with the curette, and finally with the finger nail. In those cases in which the cushion-like enlargement of the pharyngeal tonsil was met with in a moderate degree, and the consistence was less firm, the curette and finger were employed, whereas when the hypertrophy was still less and the growth soft and more friable, the finger nail alone was found to be sufficient. In only one case was the hæmorrhage alarming, and this occurred in a European boy aged 11. The growths were very firm and resistant, and necessitated the use of the forceps and the employment of a good deal of force. Just at the end of the operation a tag, of what was thought to be the growth, was removed with the forceps with some difficulty, and, as it was taken out of the mouth, looked like a small stump of mucous membrane from the left salpingo-palatine fold, near which the supposed piece of growth had been felt. Copious and alarming hæmorrhage immediately took place, and the naso-pharynx was at once plugged with cotton wool. On examination of the structure removed, it was found to be a piece of a dilated vein, probably an abnormally situated branch of the pharyngeal venous plexus, thus accounting for the excessive bleeding. The plugs were removed on the third day, and the patient made an uninterrupted recovery.

In this paper no theories have been advanced, and the subject has merely been brought forward in order to draw attention to a condition which, in Calcutta at least, is very prevalent.

It would be impossible to conclude without attempting to express the thanks that it is felt are due to Dr. Kedar Nath Dass, Medical and Surgical Registrar of the Medical College Hospital, not only for the kindly and skilful aid he had afforded the author in the treatment of these patients, but also for assisting to collate the figures on which this paper is based,

TABLE I.

Table shewing the proportion of cases affected to those examined, together with the race distribution, ratio for sexes and age incidence in quinquennial periods from 5 to 30 years of age.

		AGE IN QUINQUENNIAL PERIODS FROM 5 TO 30.									Grand Total of cases of all ages.
		Under 5.	5 and under 10.	10 and under 15.	15 and under 20	Total of cases under 20.	20 and under 25	25 and under 30.	30 and over.	Total of cases 20 and over.	
Europeans.	Males examined ..	3	9	12	26	50	19	10	45	74	124
	Males affected ..	3	9	10	13	35	2	2	2	6	41
	Females examined ..	5	3	8	9	25	13	3	6	22	47
	Females affected ..	2	2	5	8	17	3	..	..	3	20
	Total of both sexes examined	8	12	20	35	75	32	13	51	96	171
	Total of both sexes affected	5	11	1	21	52	5	2	2	9	61
Natives.	Males examined ..	6	11	12	12	41	39	35	124	198	239
	Males affected ..	3	7	4	2	16	10	1	3	14	30
	Females examined ..	3	2	4	4	13	3	11	24	38	51
	Females affected ..	..	1	3	1	5	..	3	1	4	9
	Total of both sexes examined	9	13	16	16	54	42	46	148	236	290
	Total of both sexes affected	3	8	7	3	21	10	4	4	18	39
Grand Total of all cases examined		17	25	36	51	129	74	59	199	332	461
Grand Total of all cases affected		8	19	22	24	73	15	6	6	27	100

TABLE II.

Table showing the number of patients affected with various complications among one hundred cases of adenoid hypertrophy :—

		Fauces.	Pharynx.	Nose.	Larynx.	Ears.	Tongue.
Europeans.	Males ..	32	28	19	8	9	9
	Females ..	15	16	13	...	5	6
	Total ...	47	44	32	8	14	15
Natives.	Males ..	20	22	22	11	6	9
	Females ...	6	5	6	2	2	2
	Total ...	26	27	28	13	8	11
Grand Total ...		73	71	60	21	22	26

THE SURGICAL TREATMENT OF ECTOPIA VESICÆ.

BY H. DRAKE BROCKMAN, F.R.C.S., E.,
Surgeon-Captain, I. M. S.

THE subject of my paper, though a comparatively rare one, which perhaps it has not been the good fortune of every one of us here present to witness, is one, nevertheless, full of interest from many points, and attended with such bodily discomfort, and even suffering to the afflicted patient, that I think a few minutes devoted to discussing and considering the best methods of successfully treating such a formidable deformity will be time well spent.

Before discussing the treatment of such a complaint, it would be well that we should be thoroughly conversant with its anatomy. To that end I trust I may be forgiven, if, for the benefit of those of us, who may not have had the opportunity of ever seeing and studying such cases for themselves, I just roughly enumerate the salient points of the deformity. To begin with : The deformity is essentially a congenital condition, more directly attributable to malformation and malposition of the bones entering into the composition of the anterior portion of the pelvis, combined with malformation present in the soft parts. Primarily, we find the pubic bones imperfectly developed, and the symphysis absent altogether. The result of this is that the abdominal recti muscles (which, we all know, should pass down side by side for attachment to their point of origin—the crest of the pubes and the ligaments covering the symphysis) pass obliquely outwards to be attached to the lateral abutments of the pubic bones on either side of the middle line, forming a triangular space in which there is an absence of the abdominal parietes and anterior wall of the bladder. In the place of the anterior parietes a more or less fungating mass—the posterior wall of the bladder presents itself (showing the orifices of the ureters), the mucous membrane of which is continuous with that of the skin in the neighbourhood and forming a kind of cleft extending up to the usual position of the umbilicus, which, in most of these cases, is absent. The above deformities are usually associated with one of the penis, *viz.*, epispadias. I must not omit to mention the frequent occurrence of inguinal hernia with this deformity —a factor which, if present, considerably handicaps and may possibly prevent the successful performance of any flap operation for the remedy of this complaint. A condition, such as this described, is, as can easily be imagined, productive of the most intense bodily discomfort and suffering to the afflicted patient, making it often impossible for him for obvious reasons to mix with his fellow men.

I will now pass on to the chief object of my paper—the consideration of the treatment of this affection surgically.

To begin with : The treatment may be summarily divided into :—

1. Palliative.
2. Curative or Remedial.

Of the former, I do not wish, nor have I the time to speak, for various reasons of the numerous palliative measures adopted and used in the way of instruments for wearing on the person. They are neither suitable nor applicable, at any rate, in this country.

The curative treatment is that by operation, and the chief methods devised may be conveniently divided into three heads :—

Firstly.—Are those operations designed to divert the course of the urine. Under this head comes that performed by Simon, in which the course of the urine was turned into the rectum by means of threads connecting the ureters directly with the rectum ; also that performed by Thos. Smith, in which an attempt was made to graft the ureters into the ascending and descending colon. Needless to say that both ended in failure. Lastly, the only method under this head which met with any success, is the operation performed by Sonnenburg, in which the bladder was completely removed and the ureters brought down and united to the dorsal groove of the penis, and the abdominal cleft closed completely. These operations, however, are not as a rule practicable.

Secondly.—Those operations devised for closing the defect by means of skin flaps. Of these there are many methods, such as the reversed flaps, as employed by Roux and Pancoast ; but the chief among these which require notice are those operations in which reversed and superimposed flaps are adopted as suggested and practised by Ayres, Wood, Holmes, and Thiersch. The fundamental principle in all is the same. The last differs from the three former, in that each flap is a lateral one, slightly different in shape, which is undermined and left to granulate for three weeks before final detachment, as it has to be turned down towards the inside of the bladder ultimately. In the former operations, those of Wood, etc., there are three flaps—two lateral ones, which are super-imposed at once upon a median flap previously turned down with the cuticle towards the bladder. These are the main points of difference in the operations themselves. Of the minor details of each, I have not the time to go into. Under this heading also may be mentioned Maury's operation, which consists of a perineal and scrotal flap turned up over the penis on to the defect, leaving a small hole for the penis to pass through in the centre of the flap. This is slid under a short flap dissected up from the abdominal wall, and attached to it, after vivifying the cutaneous surface of the scrotal flap. This operation, however, has the double disadvantage of having scrotal tissue for its principal flap, as well as not being practicable when an inguinal hernia exists—a factor which so often complicates this distressing complaint.

Thirdly and lastly, but by no means least, comes the operation to my mind by far the most scientific—devised for narrowing the deformed, or rather deficient, area by approximation of the ossa innominata, after previous division of both sacro-iliac synchondroses. The originator is Professor Trendelenburg, to whose ingenuity and skill we owe this most scientific procedure. By it the successful treament of this distressing complaint can be rendered more easy of accomplishment, I firmly believe, were it more generally adopted, than by any other means we have. It is to this treatment that I wish more particularly to invite your attention to-day.

It has been my good fortune to have such a case under my own care. It was first treated by the skin flap method, and, having failed after two attempts, was subsequently treated by this operation. No comparison could be made as to the effects derived from each independently.

The most obvious and difficult point to consider in treatment of this deformity is the remedy of the gap in the abdominal wall, due to the divergence of the recti muscles, which form the margins of the cleft, and allow of the protrusion of the posterior wall of the bladder. This protrusion, again, is the direct result of the bony deformity, consisting primarily in absence of the symphysis pubis, owing to separation of the lateral abutments of the pubic bones which carry along with them the attachments of the recti muscles. The first and most scientific procedure is, therefore, undoubtedly to *reduce* this gap, and to do this effectively, Trendelenburg's operation should be performed *to start off with.*

The marvellous effects of this operation were never brought home to me more vividly than in the case above referred to, which came under my own personal observation and care. In this I first tried, on two separate occasions, to attempt the cure, by operating after the method of Wood and Holmes by skin flaps, paying the greatest care and attention to the minute details of before and after treatment so necessary in these delicate plastic operations. Both of these attempts ended in failure. I determined as a last resource to give this method a trial, and did so with the most satisfactory results. I need not go into the details of it, but would finally urge that this operation be performed, as a primary measure, in these cases, subject to the following conditions :—

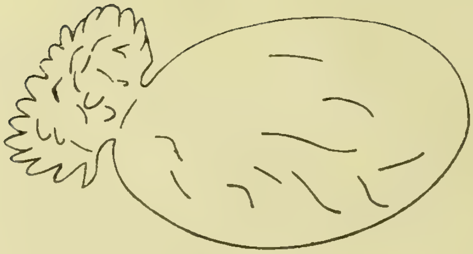
Firstly, when the subject is of the male sex.

Secondly, when an inguinal hernia co-exists (as occurred in my case. Its presence considerably endangers and prevents the successful performance of any skin flap operation for obvious reasons.

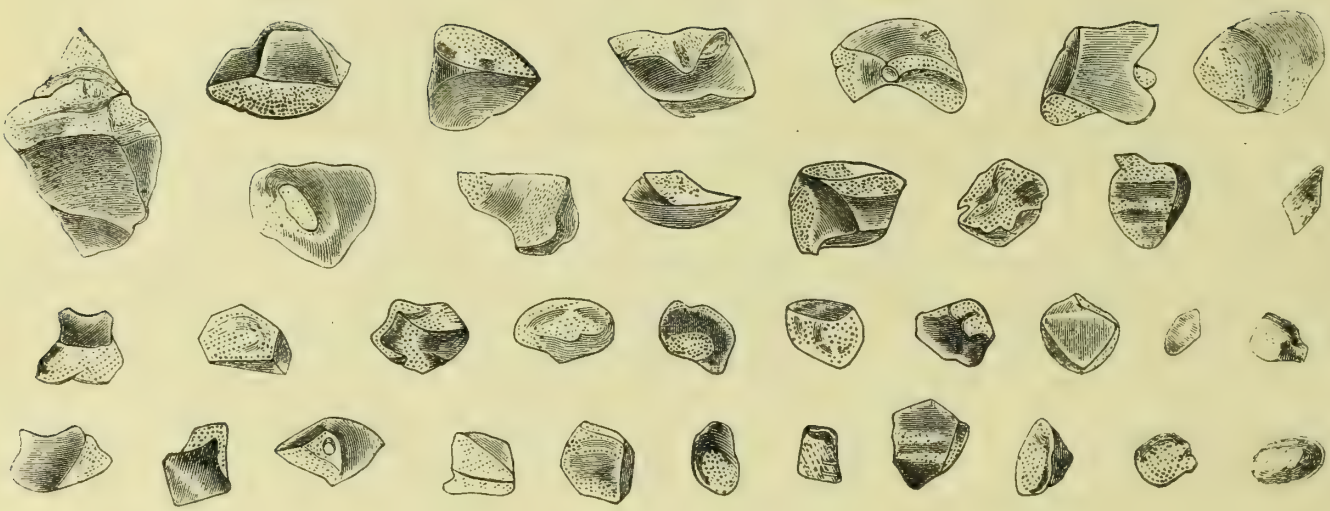
Thirdly, when the inter-pubic gap is found to be 1½ inches or over.

Fourthly, when the age of the patient is from three to five years preferably.

Where this operation performed more often as a *preliminary* measure, I feel sure that the treatment of this complaint would be necessarily shorter, less tedious, and far more satisfactory than it has been. One would not hear of such cases as that mentioned by Billroth, in which the period of treatment occupied one whole year and ten months, during which time the large number of nineteen operations was performed before relief was effected. This operation strikes at the root of the mischief, and, as far as my experience goes, has proved eminently satisfactory, as, after the approximation of the ossa innominata, the bladder



Case 1.



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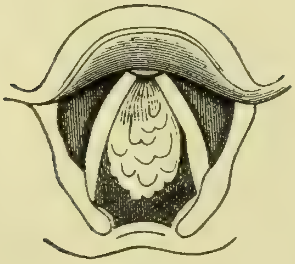


Fig. 1.

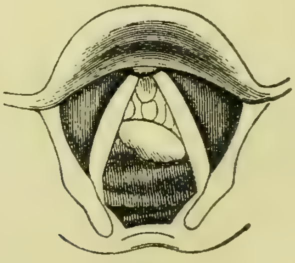


Fig. 2.

To illustrate

Intralaryngeal Tumour, pp. 206, 207.

sinks quickly into the pelvis, leaving only a small slight to be covered in, either by directly freshening the edges of the defect and uniting them by sutures, or, if larger, by making small skin flaps to cover it in. There yet remains another operation suggested by Neudorfer, which resembles the one just described in principle, but not in detail, but is, I should say, at any rate quite inapplicable in cases complicated with the co-existence of an hernia. I will not now further refer to it. The objection has been urged against the operation of Trendelenburg that it tends to weaken the pelvic girdle. This, I must confess, was not my experience of the after-effects of it. Even should this unfortunately happen, surely it is within the range of scientific surgery to remedy this by cutting down upon and freshening the edges of the pubic bones and wiring them together, if necessary, under strictly antiseptic precautions.

The deformity is of sufficient rarity, not to give many of us a chance of treating it. Should an opportunity occur I can, from practical experience, thoroughly recommend, in these cases, the performancee of Trendeldenburg's operation as a *preliminary measure*, as being one of the most scientific and satisfactory proceedings in the domain of operative surgery, which we have at our disposal for remedying, perhaps, one of the most distressing and painful afflictions to which mankind is subject.

A FEW CASES OF SURGICAL PRACTICE.

BY J. A. CUNNINGHAM, M.D.,
Surgeon-Major, I. M. S.

Case 1.—A peculiar partially encysted stone removed from the bladder of a girl aged 13 years in the Civil Hospital, Amritsar, on 13th October 1884.

The body of the stone was of oval shape, nearly two inches long by 1¼ inch in width. It was moulded to the shape of the bladder which it quite filled and had markings on the surface of the blood vessels of the bladder.

The cauliflower projection (*vide* Fig. 1) was separated from the body of the stone by a narrow neck, the entire surface of this projection was rough and coral-like. It was soft and broke down easily. The body of the stone consisted of urates with a coating of phosphates; the projection appeared to be chiefly phosphates.

The girl on admission to Hospital was greatly emaciated, she had low fever, she was stated to have been confined to bed for about five years having suffered the greatest agony. The stone quite filled the bladder which was contracted over it.

I removed the stone through a vaginal incision made downwards on a staff from the urethra.

Considerable force had to be exerted to dislodge the stone owing to the cauliflower-like projection being surrounded and grasped by a reflection of the mucous membrane of the bladder which came away attached to it.

There was very little bleeding after the operation.

The fever disappeared after operation. The vaginal wound healed of itself and the patient was discharged cured seven days after operation.

The interest of this case lies in the peculiarly shaped and partially encysted stone.

Case 2.—A patient Nathu, a Musulman male aged 45 years, presented himself at the Jullunder Hospital on 3rd May 1884 to be treated for gonorrhœa which he stated he had been treated for unsuccessfully by various Hakims during the last 20 years.

Assistant Surgeon Mehr Chand diagnosed a large stone in the bladder which has produced the symptoms mistaken by the Hakims and the patient himself for gonorrhœa.

The patient was at death's door from prolonged suffering, he looked 60 years of age. The stone quite filled the bladder.

Fearing that the stone was too large to come away through a lateral lithotomy wound, I had a lithotomy stone crushing instrument ready to break it up through the wound.

Finding that the stone could not be removed through the largest wound I considered it safe to make, I applied the crusher and without difficulty broke the stone up into pieces which were easily removed.

This patient had hiccough for days after the operation, but notwithstanding this and his extreme debility he gradually recovered, being discharged from hospital on 15th June, a month and twelve days after operation.

The fragments of this stone weighed only 6oz. 3drs., but its size was out of proportion to the weight. Its composition was phosphatic.

The date of this operation was previous to the introduction by Peterson of the India-rubber rectal bag for tilting up the bladder and increasing the extent of this orgain above the pubis uncovered by peritoneum, or I should probably have chosen the supra-pubic method for this case.

I may here mention however that from my own experience, and from what I have read in the medical journals of the experience of others, I infinitely prefer perineal lithotomy to the supra-pubic method for the removal of stones which for one reason or another are unsuitable for litholapaxy—a very small percentage.

The advantages of the perineal method are:—

1. A direct drain for the bladder, important in cystitis.
2. The possibility of keeping the patient clean and comfortable.
3. The avoidance of a wound and consequent cicatrix if not an adhesion to surrounding parts of a movable and contractile part of the bladder.
4. A better chance of recovery.

Case 3.—Multiple calculi removed from the urethra and bladder.

The patient, Kamel Din, aged 20, a Mahomedan male, presented himself at the out-patient department of the Civil Hospital, Amritsar, on January 30th, 1890, in great suffering. He stated that he had passed several small pieces of stone by the urethra, and had suffered from symptoms of stone for the last seven years.

On examination, it was found that he had phimosis, and that there were several perineal fistulæ, through which decomposed urine oozed ; only drops could be passed per urethram. He was the subject of congenial spinal curvature and talipes equinus, and altogether was a miserable specimen of humanity. His life was a complete burden to him, and he was anxious to submit to any operative procedure to get relief. The sound detected a calculus in the glans penis portion of the urethra which prevented its further passage. An enema was given, and he was at once operated on.

After an anæsthetic had been administered, the prepuce was slit up on a director, exposing the glans, and the meatus was divided for a short distance to allow of the piece of calculus being more easily extracted. The piece of stone was now seized with a pair of urethral forceps, and with a little difficulty removed ; two other pieces were afterwards found lodged at the same site and removed. The sound was now introduced, and came in contact with other fragments towards the membranous portion of the urethra ; the forceps were again brought into requisition and nine other pieces of stone were picked up and extracted with considerable difficulty from that locality. The pieces being very sharp-edged, angular, and facetted, and a few of them of considerable size, they inflicted some injury on the urethra in their withdrawal, and some hæmorrhage took place. The largest piece thus removed by the forceps measured half an inch in length, three-eighths of an inch in width, and a quarter of an inch in thickness ; it had flat sides and sharp angles, and dry weighed 8 grains.

When the urethra had been thus cleared, the sound was passed into the bladder, and revealed this organ filled with small stones, giving the sensation that a partially-crushed calculus does to the lithotrite. It was now decided to remove these by lateral lithotomy, as litholapaxy was considered inadvisable, owing to the sacculated nature of the urethra and the injury it had already sustained which required complete rest, and also the extreme irritability of the bladder, which was firmly contracted on the contained mass of calculi.

Lateral lithotomy was now performed in the usual manner, except that the incision was slightly deviated to include the two principal fistulæ, and twenty-three sharp, angular, facetted calculi were removed by lithotomy forceps without difficulty. The total weight of the whole thirty-five pieces removed from the urethra and bladder amounted to 460 grains. The composition of the stones was principally phosphates. The operation took forty-five minutes.

On January 31st, the day after operation, the patient expressed himself as more comfortable than he had been for months. The temperature rose on the evening of January 31st to 103·4°, falling next morning to 99·4°; it again went up to 100° on the evening of February 1st, fell to 99° on the 2nd, and to normal on the 3rd, where it remained till his discharge from hospital on the 10th, completely cured, and passing water through the urethra.

The illustrations are reproductions of a full-sized drawing of the different pieces, (*vide* Fig. 2).

All these three cases of stone in the bladder are good examples of cases unsuitable for litholapaxy.

Other conditions which would call for lithotomy in preference to litholapaxy are:—

(*a*) Very marked cystitis of long duration.
(*b*) A stone so hard as to resist crushing.
(*c*) Organic stricture of the urethra.
(*d*) A very irritable bladder that refuses to retain any fluid.

Case 4.—Removal (complete) of an ulcerated and bleeding goitrous thyroid gland in the Ripon Hospital, Simla, on 7th May 1894.

The patient, a female, aged 35 years, of Sirmoor, a hill state, said that she had had goitre for two years, and that it had been ulcerated and bleeding for six months. She constantly lost blood from the raw surface which was in extent about two inches square; she was in a very anæmic condition at time of admission.

I determined to remove the diseased gland and made my incisions close around the borders of the ulcer, and as rapidly as possible dissected away the entire gland, applying Spencer Well's forceps to the bleeding points. When I had finished there were twelve pairs of forceps in situ.

I found the thyroid substance soft and friable, in some places it was easily removed, but over the front of the larynx it was firmly tied down by dense fibrous tissue. The bleeding was very free.

Vessels were ligatured, but difficulty was experienced in securing two in the crico-thyroid membrane, and on those forceps had to be left and packed in the dressing till the following day when on removing them no hæmorrhage occurred.

The raw surface, after the gland was removed, was in extent about 2½ inches in each direction, and was sutured in three lines which almost closed the raw surface leaving a small space through which protruded the two pairs of forceps.

Iodoform was dusted on, and Gamgee tissue dry dressing applied.

The tension on some of the sutures was considerable, and a few of them gave way, but healing took place quickly by granulation, and 24 days after operation she was discharged at her urgent solicitation with a small healthy ulcer, not larger than a pea.

She was putting on flesh, and had lost no blood after the operation.

No news has been obtained of her since.

It will be interesting to observe if symptoms of myxœdema manifest themselves.

Case 5.—Note on a peculiar condition of disease of the external genital organs of the female prevalent in the hills around Simla, and of the existence of which I was unaware before going to Simla as Civil Surgeon.

The disease takes the form of tumour-like enlargements of the parts, clitoris or external or internal labia or of all three; the growths resemble a good deal those of elephantiasis ; sometimes they are in parts of gristly hardness and on section appear to be composed of dense white fibrous tissue; they are sometimes constricted around the base, and in advanced cases are always ulcerated at the base, the ulceration extending often along the perineum and occasionally into the rectum.

The growths come on slowly, and when ulcerated produce considerable suffering.

The treatment consists in free extirpation of the tumours and scraping of the ulcerated surfaces with a sharp spoon.

In vascularity cases vary greatly, and even in different portions of the growths on the same person difference in the vascularity is noticed.

Sometimes very smart bleeding occurs, at other times very little.

Healing takes place readily, and there seems to be no great tendency to return of the growths, but in extensive cases trouble sometimes occurs from cicatrisation. In one case which I have had under my care recently, which was operated on in the Ripon Hospital 5½ years ago, almost complete occlusion of the vagina and urethra had occurred; the urine and menstrual flow made their way through a long dense canal, which was 1½ inch long and admitted only a director. In this case I found that the patient had refused to remain in hospital till healing had occurred, and probably neglect of proper treatment was accountable for the condition found.

Causation.—All the patients who have presented themselves with this disease, so far as I have been able to make out, admitted having had syphilis, but as syphilis is not confined to the Simla hills or even to the Himalayas this alone cannot be the cause.

My friend, Dr. Brown, a predecessor at Simla, informs me that Dr. Bomford made an examination microscopically of some of the specimens of this disease, but without coming to any definite conclusions. I have spoken to Dr. Bomford on the subject, and he informs me that he believes the disease to be elephantiasis.

I have brought with me a specimen to exhibit, and this is available if any pathologist with time and opportunity cares to have it for examination.

Prevalence.—I find in looking up the register of operations that 73 operations have been performed in the Ripon Hospital, Simla, for this disease since 1st August 1885.

Case 6.—*Trephining for fracture of the skull.*—I regret to say that the detailed notes of this case have been lost, but I consider the case of sufficient interest to warrant my giving an outline of it from memory.

A young mason, about eighteen years of age, was employed building on a scaffold at the Town Hall, Mooltan, on 23rd April 1892. He fell from the scaffold on to a hard road between twenty and thirty feet below.

The Civil Hospital being only a few yards away he was carried there at once, arriving simultaneously with myself. He was quite unconscious and breathing stertorously. I found a comminuted fracture of the left humerus and a depressed fracture of the skull without scalp wound in the left parieto-frontal region.

After shaving the head I made a crucial incision turning down a large portion of the scalp, and found the depressed portion of bone about 3″ by 1¼″ firmly wedged. At either extremity of this depressed portion, I made a trephine hole, and with a Hay's saw divided the piece of bone between on the unfractured side. This enabled me to remove the offending piece of bone. A large quantity of blood which had not yet had time to clot escaped from between the skull and dura mater. The outflow of this blood was facilitated by posture.

I now observed that although a large piece of the dura mater was exposed, no pulsation of the brain underneath was observed to take place (the dura mater had not been torn or apparently injured.) I now punctured the dura mater and a spurt as from a syringe of clear cerebro-spinal fluid took place, after which the patient's breathing at once became quieter.

I conclude that a quantity of blood which could not find outlet remained towards the base of the skull between this and the dura mater, and caused the marked symptoms of compression, the puncture and escape of c. s. fluid allowed by compensation for this.

After bleeding had ceased the scalp wounds were sutured and dressed.

He shortly recovered consciousness to a small extent, and gradually improving made a fairly good recovery. His recovery was retarded by suppuration taking place in the wound.

When I was last able to hear of him, he was physically quite well, but mentally somewhat childish.

I consider that this life was saved by prompt interference. I am of opinion that had even an hour's delay occurred before operation that his chances would have been very poor indeed.

I am inclined to think that trephining and opening up the cranial cavity, a perfectly safe proceeding if carefully done, is not sufficiently often resorted to in injuries to the head.

I believe that many of the cases, where, from falls in the head at polo, &c., fracture of the base or other part of the skull takes place, and which so frequently end fatally, would be saved by resorting to early trephining as near as possible to the indicated or supposed seat of fracture, and draining off of any effused blood as early as possible after the injury. And even if no blood can be got to flow pressure could be relieved by draining off arachnoid fluid as in the above case and life possibly saved.

DISCUSSION.

G. H. Fink (Shahpur) remarked that venereal growths on the genitals at times simulated elephantiasis. The microscope should, in his opinion, decide the point. He stated that he had met at least half-a-dozen cases in the North-West Provinces. In the case of a man with many excrescences on the dorsum of the foot he tied the afferent artery. The growth of the excrescences was checked for a time partially.

C. J. Bamber (Rawalpindi) did not agree that real elephantiasis does not occur in the Panjaubis. A month previously at Rawalpindi he removed the labia majora of a woman, which were much hypertrophied from elephantiasis. The right labium weighed ten, the left one and a half pounds.

A. Powell (Cachar) endorsed Dr. Cunningham's opinion as to the advantages of perineal lithotomy over the supra-pubic operation in all except the largest stones. He pointed out that cases of small stones with putrid urine had been recorded as being treated by the supra-pubic operation and drainage of urine by a perineal wound. This to him seemed unnecessary. He pointed out that the crushing operation and the general adoption of antiseptic measures came into use at about the same time. It was therefore hardly correct to say that the mortality in adults from lateral lithotomy was 1 in 5, at any rate its mortality compared very favourably with that of our major operations previous to the time mentioned. Now, as rigid asepticism of a wound in the neighbourhood of the anus is impossible, the reverse holds good. To avoid infection from other patients he adopted the plan of treating perineal lithotomy patients in temporary huts, which are burnt in a short time if the discharges are at all putrid.

In this way out of 33 lithotomies, of which 31 were adults, there was no death. The next case in a very old man died of sheer inanition, the wound having all but healed.

K. K. Joshi (Bhopal) mentioned five cases of warty growth simulating elephantiasis, which came under his observation in Bhopal.

J. Cunningham (Simla) in reply to Dr. Fink said the growths had no resemblance to warty excrescences. All the cases admitted having had syphilis. His colleagues and predecessors agreed with his opinion that the growths were a variety of syphiloma, and not elephantiasis. If due to elephantiasis it was difficult to imagine why it was confined to the genital organs only and to those of the female. The ulceration which goes with these growths is not common in elephantiasis. It tends to extend beyond the base of the tumours. Against the filarial theory of causation he stated that mosquitoes are hardly ever seen there.

RHINOPLASTY.

BY J. M. SHAH, L.M.S.

Reparation of the nose is necessitated when that organ is damaged either by disease or injury.

Diseases that commonly destroy the nose are syphilis or lupus, and occasionally small-pox or ozœna. Injury causing loss of the nose is either accidental or criminal.

Out of the 228 rhinoplastic operations performed at the Junagadh State Hospital from 1885 to 1894, 224 noses were criminally mutilated, three noses were destroyed by accidental injury, and one was due to the ravages of small-pox. One hundred and seventy-four were women and 54 men among the 228 cases.

When syphilis or lupus is the destructive cause, the nose hardly admits of restoration unless the loss is limited. In Europe loss of the nose is due only to disease, whereby not only the cartilaginous portion, but also the osseous structure of nose is destroyed, and the remaining tissues are cicatricial and of low vitality. Lupus is rarely seen in this country; but syphilis is not unknown to cause extensive ravages, wherein the skilful assistance of a mechanician would succeed far better than the help of a surgeon.

Cutting off the nose for malice, jealousy, vengeance, enmity and outlawry is peculiar to the Oriental race, and woman is the usual victim. Moreover, the nose is technically equal to honour in Oriental estimation. When a person is addressed as having *no nose*, it means he has no honour, reputation, nor self-respect; that is why the nose is attacked in order to inflict lifelong ignominy on the victim.

When the injury is inflicted the sweep is thorough, and not only the cartilaginous nose, but adjacent portions of the cheek and upper lip are excised. When the mutilation is caused during a scuffle the loss of parts is less and limited.

Various instruments are used in cutting up the nose. Among the 228 cases, a knife was used in 123 cases, a razor in 51, a sickle in 7, a sword in 5, the teeth in 29, hatchet in one, nut-crackers in 8 and 4 were due to accident or disease.

The loss of the nose varies in extent from a small portion of the skin or cartilage, either unilateral, bilateral or central to an entire loss of the cartilaginous nose. Sometimes the osseous structure is partially cut, and not unfrequently more or less of the upper lip is excised.

In relation to the operative measures, the loss may be roughly thus classified:—

1. Loss of the tip of the nose and a small portion of the adjoining bridge.
2. Loss of a small portion of one or both alae.
3. Loss (more unilateral) of a great part or entire portion of one ala of the nose.
4. Loss (bilateral) of large portion of both alae bridge, septum and columna.
5. Loss of the nose, together with the upper lip and adjoining cheek, to a varying extent.

In one instance not only the nose and the upper lip but also the two central incisors were swept away.

In eight instances besides the nose one or both ears were cut off.

While at Ahmedabad in the capacity of teacher of surgery and midwifery from 1879 to 1885, I had the first opportunities of performing rhinoplasty. During these six years I had hardly half-a-dozen to a dozen such cases. But in the next four years from November 1885, when I took charge of the Junagadh State Hospital in November 1889, one hundred rhinoplastic operations were performed.

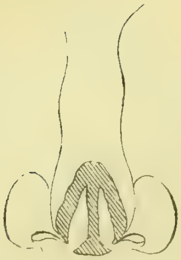
A monograph of these operations and their results, together with illustrations, was published in the latter year. In the next five years, 128 more similar operations have been done, and this gives in the first four as well as latter five years an average of 25 cases a year.

Patients resort for treatment either immediately after the infliction of hurt, or some days, months or years after the loss of the organ. When the wound heals, the parts cicatrize and contract, and the consequent disfigurement varies in different cases.

The remnant of ala is drawn up and everted; the nasal apertures become sometimes contracted to mere holes; the upper lip is everted if its cutaneous portion is lost; if its entire thickness is removed the remaining corners are drawn up and out. While remedying the original deficiency, these after-effects have also to be removed. Unless the loss of tissue is limited, I do not perform plastic operation immediately, but allow the parts to heal. When the parts have healed completely, the skin flap necessary is smaller, and there is no suppurating surface whatever in the wounds.

Operation.—Plastic operations for repairing the nose have been known from old times. The Indian operation and the Italian operation are usually mentioned in surgical works. The cheek-flap method for repair of nose is not ordinarily mentioned as a regular operation.

It is stated in Holmes' Surgery that "the operation of restoring a nose which has been cut off or lost by syphilis or lupus is one which is little in favour with most surgeons of the present day."



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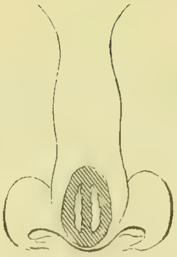

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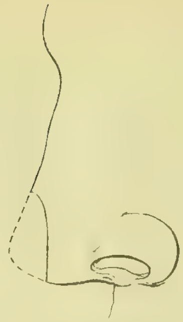

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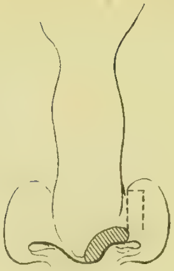

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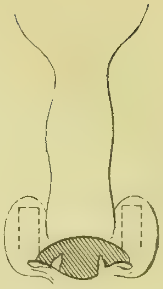

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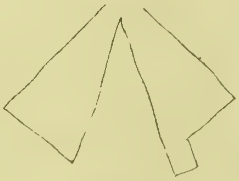

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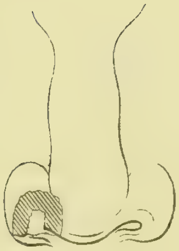

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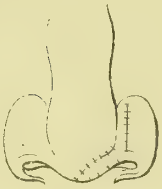

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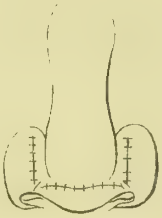

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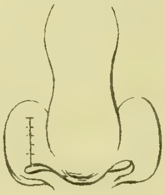

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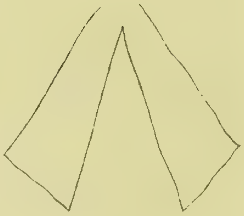

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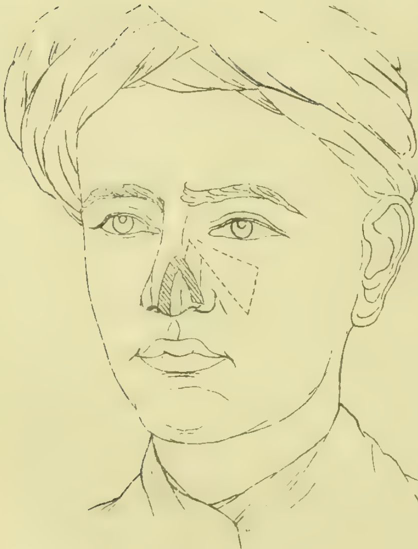

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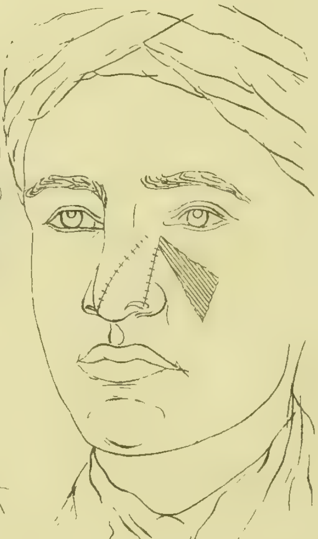

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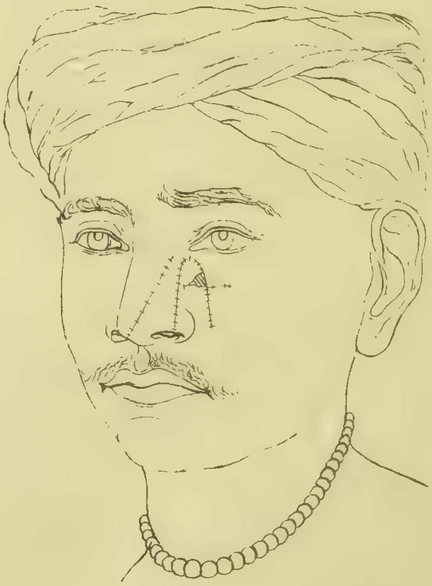


X

Reg. No. 44 Medical Congress—[illegible]

Litho., S. I. O., Calcutta.

The methods that I have adopted in restoring the nose may be thus classified:—

The nasal method, the cheek-flap method, the arm-flap method, and the forehead-flap method.

1. The nasal method means repairing the nose from the nasal tissues. It is applicable in a limited number of cases, as when the loss is small and confined only to the tip and adjacent bridge of nose, the septum and columna being almost entire. It is done in several ways; thus:—

- (*a*) When the tip and a portion of cartilaginous bridge is lost, the remaining bridge is separated from the septum by running the knife underneath it; then a vertical slice of the septum is removed so as to allow the lateral ala to approach, the margin of each ala is vivified, and then united in the middle line by a a number of sutures (*vide* Fig. I.)
- (*b*) Sometimes a wedge-shaped portion of the septum is removed so as to approximate the columna to the bridge (*vide* Fig. II.)
- (*c*) When a small portion of the tip or a small marginal portion of the ala is wanting, a small flap is taken from the entire thickness of the ala. The ala from which a flap is to be taken is transfixed a little above its margin. Two vertical and one transverse incisions are then made, and its marginal attachments are left intact (*vide* Figs. III and IV.)

The cartilaginous flap thus formed is turned inwards towards the tip and applied to its vivified surface by one or two points of suture. The small gap in the ala is made to disappear by approaching the sides of the wound.

- (*d*) When there is a small loss or a mere notch, the sides of the notch may be pared and united by sutures (*vide* Fig. V.)

II. The cheek-flap operation is necessitated when the defect of nose is unilateral, that is, when one alar portion is wanting (Fig. VI.), or when there is some obstacle in forming a forehead flap.

In my early practice of rhinoplasty, however, the cheek-flap was also utilized for bilateral defect, that is, loss of the entire cartilaginous nose, and, when dissatisfied with a series of such operations, I became a convert to the Indian operation.

Method.—Measurement of the amount of loss of nose is taken with a piece of paper. Such measurement is mostly triangular and of varying size. The paper is then placed on the cheek with its apex at the naso-ocular angle and its base obliquely downwards and outwards on the cheek and marked out with ink lines on one or both sides as the case may be (Fig. VII). If necessary, a small columna can be formed with this flap. An entire columna cannot be formed with the cheek-flap, both because it is very likely to slough, and because in most cases so much skin is not available.

When a small columna has to be formed, the angle of the flap corresponding to the tip of nose ought to be more advanced in a square form (Fig. VIII), or it may arise from the base of the flap.

After anæsthetising of the patient the skin-flap, consisting of skin and fat, is dissected up, its attachment is left by the side of the nose above, the margins of nasal deficiency are vivified, and then the flap attached by sutures.

When two flaps are formed, one from each cheek, they are united in the middle line over the bridge (Fig. IX).

When there is a remnant of the ala, the skin over it and its adjacent part is dissected up and reflected above and united with the angle of the wound caused by raising the flap (Fig. X).

The wound on the cheek is then narrowed by sutures and the parts dressed with iodoform.

The drawbacks to this operation are that the nose so formed is rather (*a*) large, thick, rounded, and retracted; (*b*) it has no proper tip; (*c*) it has no columna, which, if formed subsequently from the upper lip, is not satisfactory; (*d*) the margin of the nasal apertures have a persistent tendency to contract and retract; (*e*) marked and unsightly cicatrices are left on the cheeks.

III. The Tagliacotian or Italian method is discarded and need not occupy our time. Two patients ventured to bear the fatiguing position of the arm, but on the second or third day after the operation they tore off the flap from the nose. I am doubtful of a very satisfactory result, even if any one were found able to keep the limb in that position for sufficient time to allow adhesions of the flap.

IV. The Indian or forehead-flap method is by far the best way of repairing a nose. The chief drawback to it is a permanent scar on the forehead. In India this is easily screened by the headdress or by a mark of red gum that people make as a religious observance on the forehead.

Method.—This method requires several distinct steps, which may be enumerated as (1) shaping of flap; (2) mapping it on forehead; (3) its dissection; (4) vivifying the nasal surfaces, and, if possible, forming a triangular flap; (5) twisting and suturing the flap to nose; (6) dressing; (7) management of root.

1. To take a proper measurement with paper, of the necessary size and shape of the flap requires experience and practice. It will vary with the extent of loss of the nasal parts. Allowance must be made for contraction of skin after dissection of the flap as well as of the loss of the tissues in vivifying the nasal parts.

2. The paper measure is next placed on the forehead and marked out with ink lines (Fig. XI). The neck of the flap is inclined to the inner angle of one eyebrow, and its inner edge corresponds almost to the middle vertical line.

The breadth of forehead varies in different individuals from about 1½ to 2½ inches from a point midway between the eyebrows to the margin of the hairy scalp. The skin-flap touches or encroaches upon the hairy surface to a varying extent. The columnar portion is mostly more or less derived from this region. The columna is square shaped, and the corners of the skin-flap are acute angled (Fig. XII) and not rounded as seen usually in the diagram of surgical works.

3. The flap is dissected up from the pericranium. Its upper portion is first raised, then the nasal surface is vivified, and lastly the neck of the flap is formed.

4. Incisions are made to pare the nasal region, one commencing on each side at the external angle of nasal aperture, and carried upwards along its margin obliquely to the root of the nose, so as to meet the middle line incision of the forehead-flap.

When both these incisions meet above they include a triangular surface of nose (Fig. XIII). The apex of this triangle is dissected up to almost its very base above the nasal aperture. This is an important step.

This triangular-flap varies in size according to the extent of nasal bridge left intact after infliction of wound. If it is large, a portion of its apex is incised and grafted in the forehead wound. This flap is turned down and attached to the under surface of the forehead-flap. It serves to support or prop up the new nose, and supplies to a great extent the deficiency of the septum.

In cases where the triangular bridge-flap is not available and the septum is wanting, a piece of sponge, lint or pasteboard is retained so as to prop up the new nose till it is thickened and stiffened by exudation.

After the formation of this flap, the margins of skin along both sides of nose are freed by running the knife along it. This step is important, inasmuch as it secures even union of the flap and prevents grooving at the line of junction. Lastly, a cut is made above the lip for the reception of the columna.

5. When all bleeding has ceased the forehead-flap is turned down and applied appropriately by a number of horse hair sutures to the nasal region. Care is necessary in attaching the columna in uniting the angles of the flap and in applying sutures at the very twist of the flap.

Wooden plugs are retained in the nasal orifices. The plugs are somewhat conical and hollow.

6. After uniting the flap to its new position the more or less extensive wound of the forehead is contracted, and lastly, iodoform is sprinkled and lint is applied and retained by sticking plaster.

7. After-treatment of the cases has puzzled me most in rhinoplasty. Surgical books simply mention division of the root of flap when firm union has taken place. In my earlier practice, the entire nasal bridge was not vivified. Holmes appears to adopt the same method. The neck of flap then remained like a raised ridge over the bridge after dividing the root at the point of twist. The opposite surfaces of the root and nasal bridge were subsequently pared and united by what I then termed 'secondary rhinoplasty.' Subsequently an incision was made vertically on the bridge, the skin dissected up on each side and united to the edges of the forehead-flap root. This method afforded very satisfactory results. Laterally, however, as already described, when paring the bridge, a triangular flap of skin is dissected and utilized in supporting the new nose.

Now, division of the root in its original true sense is not necessary. In cases where an elevation is perceptible at the seat of the twist, a wedge-shaped portion of skin is excised, so as to obliterate the prominence and the sides of the wound are united by sutures. This is not done earlier than two weeks after the operation. In other cases where no prominence is perceptible, nothing more remains to be done.

Bryant recommends the removal of sutures on the second or third day. I use horse hair sutures, and do not remove them before a week; they do not irritate the wound.

After-treatment.—It may be said, once for all, that the operation is done antiseptically. In most cases the flap unites to the nasal surface by first intention, and the first dressing is not changed before the completion of one week. When dry, it causes tension on the second or third day; carbolic oil is then applied to it; subsequent dressing is changed according to requirement.

The forehead wound, which has to cicatrize by granulation, takes longest to heal. It is very often grafted with skin, either immediately or subsequently.

Columna.—Erichsen recommends to form the columna from the upper lip, even in this Indian method of rhinoplasty. I have always formed it with the best results along with the forehead-flap.

I have had two or three occasions to form the columna from the upper lip; but it has not proved so satisfactory as when formed from forehead.

Cheiloplasty, or reparation of lip, has been practised in various ways according to the amount of loss of lip; but the limit of time placed on the perusal of paper prevents me from making any observation on this subject.

DISCUSSION.

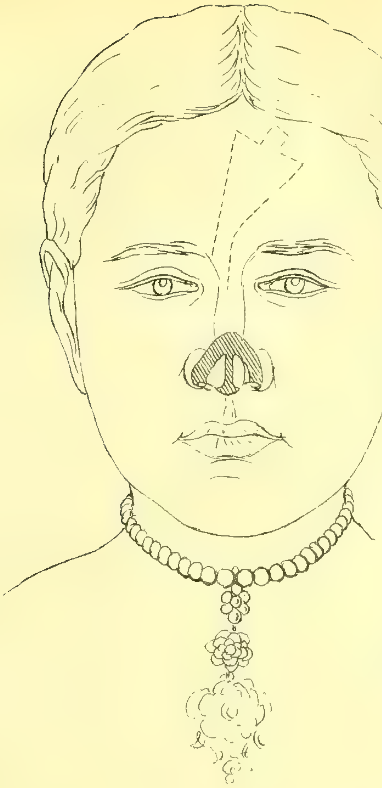
N. V. Bhagvat (Indore) considered the first step was to make a raw surface over the bridge of the nose and along the sides to receive the raw surface of the flap from the forehead. Time was thus given for all oozing to cease before application of the flap. He thought stiffish india-rubber tubing preferable to plugs of wood, as there was less likelihood of injury. He considered division of the root of the flap necessary, and always split it into two portions before removing it. He always cut the column long in order to secure a good tip to the nose and broader at the ends than at the centre.

Behari Lal Chuckravarti (Calcutta) said that rhinoplasty was uncommon in Lower Bengal, and as far as his small experience went the results of operation were not always satisfactory

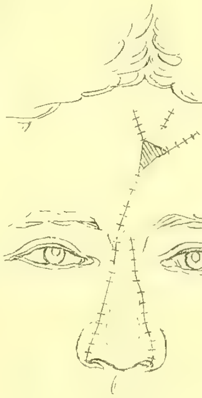
SOME DIFFICULT CASES OF CHLOROFORM ADMINISTRATION.

BY ARTHUR NEVE, F.R.C.S., ED.,
Kashmir.

THE fact that for all practical purposes ether is not available as an anæsthetic in India should enable the profession here to regard the chloroform controversy from an unbiased standpoint. Here it is not a matter of choice; but it is not reasonable to declare that because chloroform is the only available general anæsthetic in India, therefore it is the best in a cool climate. Nor, if



XI a



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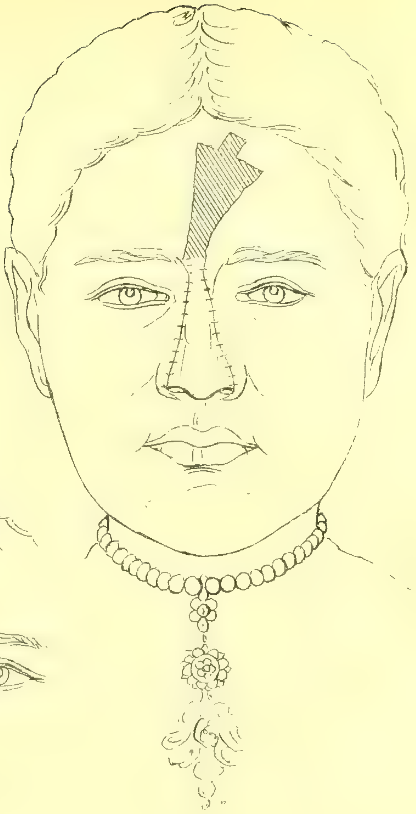

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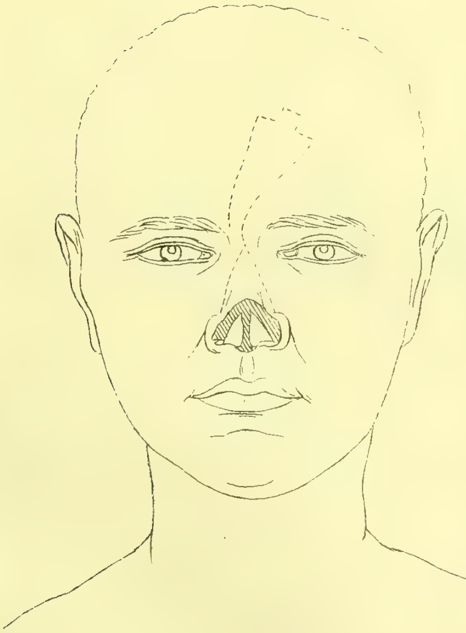

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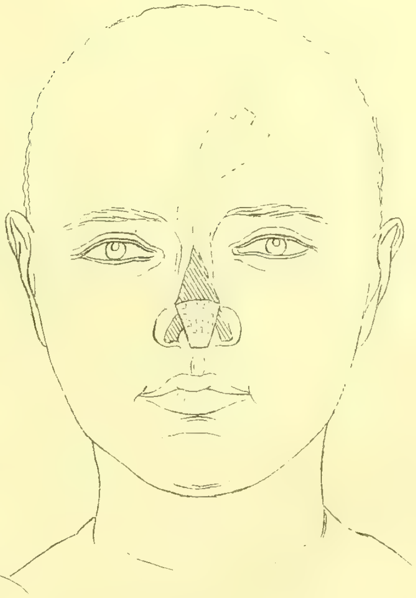

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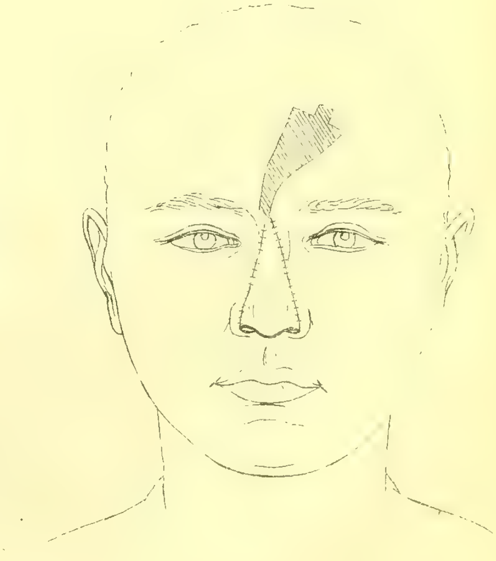

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it could be proved that it is absolutely safe in this country, should we settle the controversy in any way. India could contribute two important facts, which perhaps may be elucidated at this great gathering. *First*, the relation of race to anæsthetics, and this might include the question of racial habits, such as vegetarian diet and abstinence from alcohol. *Secondly.*—The effect of temperature and altitude upon chloroform anæsthesia. Can any clinical difference be established between the administration to natives of India of chloroform in hot weather with a mean temperature over 85°, or in cold weather with a mean temperature of 50° or lower at such stations as these temperatures occur, and does an altitude of 6,000 or 8,000 feet affect the question clinically? These practical contributions to debatable points might reasonably be speedily expected from Indian surgeons.

A New Zealand surgeon claims that careful study of cases shows that the aborigines there are less liable to suffer from shock, and that Europeans, if insufficiently anæsthetized, are apt to die from inhibition of the action of the heart. Does Indian experience homologate this view? Could an Indian committee be formed to investigate all fatal cases occurring in this country?

I published a case in the *Lancet* (Vol. II, 1892, pp. 14, 16), in which partial anæsthesia plus shock caused very serious symptoms. It referred to a strong Kashmiri, who required castration for sarcoma of a testicle. Owing to vomiting the anæsthetic was insufficiently administered; and at the moment of applying a clamp to the cord, the patient became rigid as in a tetanic spasm, and the heart's action stopped; the wound ceased to bleed. With difficulty, after inversion, injection of ammonia, and also *per rectum* of hot water, together with steady artificial respiration, the pulse began to flicker, the chest heaved, and the patient was restored. As he was sensitive to the knife, I then rapidly administered two drachms of chloroform, which the patient inhaled quietly, and the operation was finished deliberately and safely.

I am convinced of the importance of this and similar cases.

One which I narrated at the British Medical Meeting at Bournemouth has the same lesson. A patient suffered from both severe heart disease and from stone in the bladder. Chloroform was timidly given, and as the staff was inserted the patient gave a gasp and fainted. He was with difficulty restored to consciousness. A fortnight later I arrived in the town, and was consulted. I offered to administer chloroform myself. Two drachms were given and the operation was begun. As the patient had taken chloroform quietly all seemed well; and I was asked to assist in the operation, leaving the House Surgeon to continue the administration. Scarcely two minutes had passed before the breathing appeared to stop. What was the cause? An overdose? No. For no more chloroform had been added. It was the shock acting reflexly on a heart neither protected by consciousness nor by full anæsthesia.

I append two cases of faulty administration that have occurred this year out of over 500 chloroformizations under my care.

In both cases I was summoned from an adjoining room where I was operating. In one a native assistant of considerable experience was operating, while another, who has chloroformed thousands of patients, gave the anæsthetic. When I entered the patient had been partially inverted, the operator was performing artificial respiration, while the other drew on the tongue with the head back.

But observing that the lips were purple which witnessed to continued action of the heart, I at once put my finger down behind the tongue and raised the epiglottis. Immediately one heard the air rush into the chest; and in less than a minute a sighing inspiration showed that natural respiration was recommencing. In this case I think an overdose had been given; and the tongue had fallen back, and the traction upon it did not suffice to open a flaccid epiglottis.

The other case was one in which chloroform had been badly taken; the patient struggling a little and afterwards incesssantly spitting. Anæsthesia was pushed to stop this annoying reflex symptom, and the moment it ceased the respiration also stopped, and the patient turned pallid.

When called in I lifted him on the ground with his feet and body up, and began artificial respiration; the air entered the chest, but for a few seconds the absolute pallor remained. Then there was a slow natural inspiration; recovery was slow for a minute, and then with a heave of the body vomiting began, and the stomach emptied itself of 2lbs. semi-digested rice.

Here, as in other cases, the syncope was connected with a full stomach, and was premonitory of the vomiting.

There were two other cases very noteworthy.

One, a woman, with a gumma over the thyroid cartilage with considerable dyspnœa, and a constant spasmodic cough. I administered chloroform myself, and began with a dose of 10 minims on the towel. There was a moment of struggle, then she lay senseless, the operation was begun. Her breathing was almost imperceptible, and pulse thready. No more chloroform was given, and the operation which lasted about 20 minutes was completed without a sign of consciousness, but soon afterwards she came slowly round. The other, a lad, with very great dyspnœa from the pressure of a goitre which, with each inspiration, was sucked down behind the sternum.

As in the earlier case only a few drops of chloroform were given, Dr. W. F. Adams kindly taking charge of the anæsthetic. I had well begun the operation when breathing stopped, and also the bleeding except some venous oozing. No more chloroform was given. The legs were raised and artificial respiration begun, &c. I went on with the operation, and removed the portions of the goitre resting over the trachea. Still he remained unconscious, with great dyspnœa, owing to the flattened and infantile condition of the trachea. So about quarter or later, I proceeded to open the trachea below the cricoid cartilage. An ordinary tracheotomy tube gave no relief, so I inserted a gum elastic catheter for 3 inches down the trachea. Shortly after this the patient began to show symptoms of returning consciousness.

In both these cases the blood was very venous, and the poisonous effect of the chloroform upon the medulla oblongata was at once manifested even in minute doses. There have been upwards of *six thousand* administrations of chloroform since 1875, without a simple direct or indirect death, in the Kashmir Mission Hospital.

Not a year passes without dangerous symptoms occurring in a few cases.

We have seen (1) primary syncope from fear, and also from (2) laryngeal spasm; (3), secondary syncope from shock due to insufficient chloroform, and also from a proper dose acting on non-oxygenated nerve centres; (4), tertiary (sometimes secondary) syncope connected with vomiting, (5), apnœa from (*a*) mechanical causes, (*b*) spasm of the larynx, (*c*) from the toxic action of an overdose (relative or absolute) on the nervous centres.

In any of these ways life may be lost. The surgeon must hold clear views on the method of administration, so as to steer as clear as may be practicable in any given case of these various dangers; and he must be prompt to recognize the danger signals of a dilated pupil, or gasping or stertorous breathing, or change of colour in the lips. He must also be thorough as well as prompt in his method of restoration.

If he have fewer accidents than his fellows, let him not attribute any special credit to himself, still less apportion blame to his neighbours, for the time may be near when he will himself meet with a fatal case due to idiosyncrasy of the patient.

DISCUSSION.

A. Powell (Cachar) said I have come to the conclusion that ether and nitrous oxide owe their safety to the fact that, as they are administered with a limited supply of air, partial suffocation assists them in their anæsthetic effect. With them when danger appears we have only to perform artificial respiration, and the impending asphyxia is averted.

With apologies to our distinguished President and the shade of Syme, I rise to announce the heterodox opinion that if chloroform be administered with a limited supply of air from a closed apparatus, safety is increased. A smaller quantity need be absorbed, as we have two anæsthetising factors—asphyxia and chloroform,—and should danger arise, it will in this case be most certainly due to a failure of respiration, for which we have a ready and certain cure in artificial respiration.

This opinion I have carried out in my practice. Seven years ago, when Resident Surgeon and Anæsthetist in the Belfast Royal Hospital, I commenced to administer chloroform from an Ormsby's inhaler, rousing the strong opposition of all the surgeons, who unanimously declared I was bound to kill my patients.

Before I left the hospital I had given it in this manner in 270 cases, and all the surgeons, including Mr. Fagan, Professor Sinclair, and Mr. Waltson Browne, came round to approve of the method.

I have no doubt there are some here who have seen me use it there.

I have now in India and Europe used this method in 1,070 cases, and in only two had I cause for the slightest alarm. These were the only two I have ever had to slip with towels and use the tongue forceps. In eleven cases I have performed artificial respiration for half a minute or so when the vapor apparently irritated the larynx and subsequently continued the chloroform.

One of the above two cases, an elderly European gentleman, of cyanosed and flabby appearance, was operated on by Mr. Fagan for piles, which, before administering the chloroform, I expressed my opinion were unsuitable for operation, as due to a fatty heart. The pulse was 46 per minute, with an intermission after each fifth impulse. After the operation the intermission appeared to represent two beats in point of time; the pulse became very feeble and respiration getting shallow ceased. Artificial respiration at intervals brought him round. This is the only really serious case I have had. The other "flipped" case was a coolie who merely held his breath through fear.

Whilst holding the Ormsby's mouthpiece over the patient's face—I blush to say it in the present company—I keep my ring or little finger on the facial pulse. Should this give any indication of failing, or should the respiration become shallow, a little ether is put in the apparatus to stimulate it.

The alternate filling and falling of the rubber bag is a sure index to the state of the respiration, which, under the chloroformist's very nose, thrusts itself on his attention.

By this method the patient is "put under" much more rapidly and with much less chloroform than in the open method.

In conclusion, I again apologise for my heterodoxy, for which my excuse is that either I or my assistants (and even my bearer) have used it in 1,070 without a casualty and with much more rapid results than any other method.

In cases of weak and flabby heart, or in mitral disease, I would prefer to use ether; but in aortic valvula disease, I would strongly advise chloroform, as the struggling and excitement of ether are most to be feared.

INTRA-LARYNGEAL TUMOUR.

BY J. SMYTH, M.D.,
Surgeon-Major, I. M. S.

INTRINSIC laryngeal disease does not seem to have attracted much attention in India. I find only one case in such Indian medical literature as I have at my disposal. It is a case of laryngeal cancer. The larynx was successfully extirpated by McLeod of Calcutta. The case is reported in Volume 26, *Indian Medical Gazette.*

In the out-patient practice of the General Hospital, Madras, affections of the larynx are by no means infrequent, and I have been able to collect several cases of interest.

From these I select the following one as it presents some points worth noting. Such cases are probably not uncommon, and I hope that workers in this department of the art of surgery in India will contribute their experience also.

My patient was a Brahmin youth from Mysore, aged 18 years, admitted as an out-patient to the General Hospital, Madras, in January 1891, suffering from extreme hoarseness. He said he had been slightly hoarse as long as he remembered, but on close questioning I found that hoarseness was not the true character of his voice. His voice was harsh rather than hoarse. He was regarded as rather loud-voiced than otherwise.

In January 1890, just a year previous to his admission, he went to bathe at different sacred pools and caught a slight cold. During one of these baths, as he was plunging about and shouting to his chums, he suddenly became voiceless but felt no pain. He has remained voiceless ever since, and been constantly under treatment, both native and foreign, without benefit. During this period he has suffered neither pain nor dyspnœa, but the effort of phonation has been gradually getting more fatiguing, so that, during the last few months, talking puts him into a profuse perspiration.

On the day he appeared at the General Hospital, he seemed a fine healthy boy, in excellent spirits notwithstanding his condition.

He spoke with great expiratory effort, the beads of sweat starting on his brow and the face becoming livid. There was no pain, and no evidence of dyspnœa except when talking, no cough except after swallowing some sappid substance, no expectoration. General health good, no visceral disease, no evidence of syphilis acquired or inherited, no glandular enlargements, pharyngeal veins probably slightly dilated, and post pharyngeal follicles larger than normal, no obvious catarrh.

As there was no pharyngeal engorgement, pain, cough or expectoration, I concluded the case was not one of mere chronic catarrh of the laryngeal lining, and so examined him with the laryngoscope. The faucial aperture was very narrow, so that only the medium sized mirror could be used. I saw a firm-looking, lobulated, pale-red tumour, about the size of the last phalanx of a medium-sized woman's little finger, between the vocal cords, having its origin apparently from the base of the epiglottis below the anterior insertion of the vocal cords. It projected slightly upwards and to the right, so that there was a free air-way through the posterior part of the *rima* extending forwards for a short distance on the left side of the tumour. The cords were of course widely separated. During phonation the tumour was firmly grasped by the cords. Its surface seemed covered with a thick mucous membrane, and showed no tendency to ulcerate. It looks somewhat like an oblong half-ripe raspberry. The false cords and the neighbouring laryngeal walls were somewhat congested. No signs of infiltration anywhere. (*Vide* Fig. 1.)

Surgeon Major W. B. Browne then examined the growth, and agreed with me in the opinion that it was probably a simple tumour, and that it should be removed.

About that time the medical papers contained a great deal of polemical literature on the subject of intra-laryngeal interference with growths, several writers who should have known better stating that such interference not infrequently converted simple into malignant growth. I suppose they based their observations on the chronic irritation caused by the "cutting" pipe or the preputial concretion. The analogy seemed very far fetched, so I decided to remove the tumour under notice intra-laryngeally.

As I had no instruments fit for such a proceeding, Annaswamy, chief cutler to H. M. Medical Stores, Madras, made me a wire ecraseur, using the finest steel zither wire. The ordinary wire ecraseur does not cut the tissue clean through. There is consequently often a good deal of tearing in the final removal of a tumour by its means. This I judged very undesirable in an intra-laryngeal operation for obvious reasons. So I had the instrument so made that the wire when drawn home might retreat quite within the tube of the ecraseur, and fit it so closely that any tissue in its grasp was sure to be cut clean through.

The workmanship on this tube would have done credit to Weiss.

On 27th February 1891, guided by the laryngoscope and with the larynx well cocainised I cut away half the tumour. There was some bleeding, so I applied a swab of Ruspini's styptic to the cut surface. The bleeding soon ceased. The patient was able to phonate with ease immediately, but still very harshly. (*Vide* Fig. 2.)

Two days later I examined the larynx again, but the remains of the tumour were a bit obscured by small shreds of clot, and I thought the glands about the hyoid bone were slightly enlarged.

On 14th March, *i. e.*, seventeen days after the operation, I again examined the parts. The stump of the tumour was now very clearly seen, cut obliquely, closely resembling a small ham cut across. It had shrunken considerably. I determined to wait a while longer to watch whether this shrinking process would continue.

On 21st March I found no further diminution in the size of the stump of the tumour, so I cut it clean away. There was only slight hæmorrhage.

On 25th March no trace of tumour was visible; cords moving freely, phonation excellent.

Three months later he wrote to me: "Quite well by the grace of God, throat getting better and better, studying for F. A. at Maharajah's College, slight hoarseness still."

In November I examined him carefully: Voice still a little hoarse. No appearance of recurrence. Cords moved equally well, patient in excellent health and spirits.

30th April 1893.—No appearance of recurrence. He said his voice was a little hoarse in the mornings. Quite clear then however.

NOTE.—Surgeon-Major John Maitland was kind enough to prepare sections of the tumour for me The sections presented all the appearances of an epithelioma! This fact is not without its lesson.

CLINICAL REMARKS ON THE TREATMENT OF SOME BONE DISEASES.

BY ARTHUR NEVE, F.R.C.S.E,

Kashmir.

In one of the best recent manuals of operative surgery no information is supplied on the subject of the operative treatment of bone diseases otherwise than by excisions of joints and amputation of limbs.

This is the more extraordinary in that, while the general practitioner may record most bone diseases from the cod liver oil and change of air standpoint, most hospital surgeons find they demand boldness and prudence, sweeping resection, or cautious diagnostic incisions in a greater degree than almost any other class of surgical diseases. On the one hand a case may require simply tonics, counter-irritation or a splint; on the other hand, incisions and counter-punctures, trephinings, resections or even amputation, and the more promptly the earlier operations are undertaken the seldomer will amputation be required.

Very much may be summed up in the rule *Relieve tension.*

Tension is painful and injurious in proportion to the rigidity of the tissue in which it occurs. More so in fibrous than in areolar tissue, and most of all in osseous.

If unrelieved, not merely will the inflammatory products burrow and extend, but they will cause necrosis. An ill-treated whitlow may lead to amputation of the finger.

An ill-treated acute periostitis of the tibia, amenable in the first instance to simple drainage, may involve the whole bone in necrosis, or spread to the knee-joint.

Asepsis is of the utmost importance, greater than in soft tissues. If at the same time that pus is evacuated pathogenic germs are permitted to enter, pyæmia may be set up, or lingering caries or necrosis result. An aseptic incision to the bone in acute periostitis, or aseptic trephining or drilling of the bone itself in osteomyelitis, will in many cases completely cure the disease.

In one sense most inflammatory disease of bone is septic, that is, connected with micro-organisms, such as the staphylococcus aureus, but this need not hinder a clinical aseptic healing. If streptococci, or pyogenic bacteria gain access to the bone, necrosis or caries will almost certainly follow.

How much relief amounting to cure may be seen in tubercular or syphilitic epiphysitis from appropriate non-operative measures, or from a simple aseptic incision. But if a septic sinus exists, how troublesome to heal. Which so-called tubercular caries or syphilitic caries is really *septic* caries?

Where a septic sinus leads into a bone, no amount of antiseptic syringing, etc., will destroy the septicity, which is interstitial. The diseased cancellous tissue must be scraped away, and the cavity well cleaned out, or perhaps tamponed with an antiseptic plug. Examples of the benefit of relief of tension are seen in periosteotomy, subcutaneous or otherwise in chronic periostitis, in drilling for bone abscess, for epiphysitis, or osteomyelitis.

When operating for acute suppuration in connection with a long bone, it is well to make an incision that will allow of digital examination of the surface of the bone in the neighbourhood of the epiphyseal line. If it is then felt to be soft or roughened, it is well to drill the bone at once so as to allow the escape of any pus.

Sometimes this line will be found already disintegrated. What should then be done? This depends on which bone it is.

If the *femur*, it is of primary importance to preserve its continuity.

So a splint should be applied to prevent accidental fracture. I have seen a case in which the shaft separated from the condyles and protruded through the skin by the knee. In a few weeks there will be a sufficiently firm case of new and ossifying tissue to maintain the length of the limb, but yet not too hard to be cut with a knife or stretched so as to permit extraction of the sequestrum. If left longer, the operation of removal is much more formidable. From the fifth to the eighth week of disease is the best period for operating on the femur.

For the *Humerus*, a similar rule might be formulated, though I have seen no harm from much earlier sub-periosteal resection.

In the *Leg* and *Forearm*, the bones being double, one of them acts as a splint when the other is removed. Accordingly in the *Tibia*, given extensive osteomyelitis, which often leads to softening of the upper and lower ends of the shaft simultaneously, we practise complete resection of the bone. Upwards of 40 cases have been thus treated, and in only one did osseous growth fail to replace the bone. Early resection saves limb and saves lives. The only thing that can be admitted against it is that it occasionally sacrifices an unnecessary amount of bone.

There is a form of interstitial disease frequently seen in the tibia and fibula in which the central parts of the shaft seem most affected. We term this for convenience *spicular necrosis.* In this the periosteum is not distended by one far spreading abscess. There will be several points of redness and softening. Each of these will be found to correspond to a bare spicule or lamella of bone, and the probe may be passed in towards the medullary cavity, for similar necrosed fragments are found there. In such cases it is our practice to expose the shaft by a bayonet-shaped incision. With a sharp chisel (Macewen's osteotome) the medullary canal is laid open and diseased portions removed. In cases where the bone is already hypertrophied, it is difficult to fill up the trench thus made with granulations or to get the skin edges into apposition. Thus a double purpose may be served by chiselling away one whole side of the bone, leaving its periosteal covering, which is then applied like a flap to the whole fresh surface of bone. It thus heals without prolonged granulation, and the skin unites without tension.

Sequestrotomies have to be frequently performed by every surgeon. It is often difficult to decide whether a deep sequestrum is present. In the lower part of the femur, or upper part of the tibia, especially large suppurating cavities are met with, in which there is no sequestrum; the walls are lined with weak and fœtid granulation tissue. In such a case also it is well not merely to gouge the walls, but to remove so much bone on one side as to allow of a flap of the soft tissues being applied to the cavity. The granulations cannot grow from the bone in such cases on account of its sclerosis, and want of vascularity. The granulations from the soft tissues will be vascularized, and thus the cavity may heal.

Chronic sinuses with little discharge are met with in or about the popliteal space, which depend not upon a sequestrum, but are due to the movement of the hamstring muscles over a formerly diseased bone, from which the periosteum has disappeared; and although the bone is practically healthy, yet granulations will not grow, nor the parks adhere. A chronic and practically incurable sinus is thus formed. Perhaps the best results are got by chiselling to obtain a fresh surface of bone, and applying a splint, with pressure behind, so as to get adhesion of the parts.

Bone grafting is of utility in filling the aseptic cavities of bone abscesses. For the same purpose sponge has been used. I have tried for 18 months past gelatine as a stuffing. It should be prepared with carbolic lotion, and a weak solution, half per cent., of chronic acid.

It seems to me free from the drawbacks of sponge, decalcified bone or catgut. One great advantage is, that, if not speedily vascularized, it disintegrates and disappears.

Living bone grafts from the epiphyscal region are useful to fill gaps in bone. In one case I thus obtained union in the tibia of a child after fracture with loss of tissue.

To sum up briefly, I would put in a plea for—

(1) Early drainage of the bone by drilling or trephining to save in necrosis, &c.

(2) Early sub-periosteal resection to prevent pyæmia, exhaustion by discharge and prolonged suppuration.

The average resection heals in ten weeks soundly and without deformity.

(3) Osteo plastic operations for spicula necrosis or to close old cavities.

(4) Gelatine grafts as a scaffolding for organizing blood clot in aseptic bone cavities.

(5) Epiphyscal bone grafts to fill gaps in the continuity of a long bone.

FILARIAL DISEASE.

BY J. MAITLAND, M. D.,
Surgeon-Major, I. M. S.

ELEPHANTIASIS and other diseases caused by the *Filaria Bancrofti* are so widely prevalent in certain parts of India, and there is still so much to be learnt regarding them, that the subject seems to be an especially fitting one for discussion at this Congress. Filarial disease appears to be prevalent along the whole coast line of India, and in some places, such as Shirtullay in Travancore and Streehareekota in the Nellore district, a large proportion of the inhabitants are said to be affected. Yet the disorder is often so insidious in its approach that cases are frequently overlooked by medical men, and there is strong reason for believing that the disease is much more common than is generally supposed.

It is exceedingly important that we should be able to recognise the disease in its early stages, as much may then be done to mitigate it if suitable measures are adopted. Moreover, the medical man in India is so frequently called upon to examine candidates for employment in the service of the State, or recruits for the Army, or applicants for life insurance, that he should always be on the alert to detect the early manifestations of these disorders.

Dr. Manson has written so recently and so exhaustively on this topic, in Davidson's "Hygiene and Diseases of Warm Climates," that I have no intention of going over the general facts which he has so well described. All surgeons who have had much experience of filarial disease will probably agree with him in most of his conclusions, and more especially so in his opinion that the so-called Elephantiasis Arabum is merely one of the many manifestations of this protean disorder.

My chief object, however, is not to discuss any of the matters treated of so fully in the above mentioned work, but to describe certain new facts which have come to light within the past eighteen months, and to discuss their bearing upon the pathology and treatment of certain forms of filarial disease.

Before proceeding further it will be well to give a brief outline of certain cases to which frequent allusions will be made, and upon the facts of which most of the following observations are based:—

No. I.—This was the case of a young Eurasian who, although he had embryo filariæ in his blood, did not present any other evidences of disease. One day he received a blow upon his arm and this was followed in a week's time by an attack of lymphangitis at the injured part. The inflammation quickly subsided under treatment, but left an induration of the part affected. The lump of thickened tissue was excised, and on dissection was found to contain a number of mature filariæ.

No. II.—This was a somewhat similar case to the last. A Mahomedan lad who had filariæ in his blood, and who was suffering from an attack of acute synovitis of the knee joint, said to be of traumatic origin, suddenly developed lymphangitis of the arm. The inflammation soon subsided, but left two thickened masses which were subsequently excised and found to contain a number of mature filariæ.

No. III.—This was a Eurasian lad who had enlarged glands in the femoral region on both sides and who also had filariæ in his blood. He had suffered from a few attacks of mild fever, but was otherwise in apparently good health. The mass of glands on one side was removed, and on dissection was found to contain several mature filariæ. The operation was followed by complete disappearance of filariæ from the blood.

No. IV.—A Hindoo youth had enlarged and varicose glands in the femoral region on one side, and filariæ in his blood. He suffered from frequent and severe attacks of pain and fever. The glands were removed and the attacks of pain and fever ceased.

No. V.—A Eurasian lad with a swelling similar to that in the last case but with no filariæ in his blood. He also suffered from attacks of pain and fever. The glands were removed, but without benefit.

No. VI.—A similar case to the last. A Eurasian lad with varicose groin glands, but with no filariæ in his blood. He suffered from periodic attacks of pain and fever. The glands were removed, but the result of the operation is not known.

Some of the filarial worms obtained from one of these cases were examined by Dr. Manson, and a description and illustrations of them were published in the *British Medical Journal* of the 21st of April last. On comparing them with the description and drawings of the worms previously described by Magalhaes, Dr. Manson was of opinion that these were specimens of the mature *Filaria Bancrofti*, but that Magalhaes' filariæ are quite a new species.

Some of the cases which I have briefly narrated afford us new and interesting information regarding the habitat of the filariæ and the manner in which these parasites dispose themselves in the lodging that they select for their residence. Surgeon-Lieut. Elliot, who very kindly examined the mass of glands removed from the third case, says that, "while dissecting a mass from one of the larger glands, a capsule seemed to have been burst, and a much coiled elastic mass of worms sprung open with a watch-spring-like movement." And further on he says: "While dissecting one of the smaller glands a membranous material which apparently acted as a capsule was torn across and a third worm discovered." His observations led him to conclude that the worms were in all probability encapsuled, and they certainly were enclosed under pressure. In the tissues removed from the second case the parasites were contained in small cyst-like cavities about an eighth of an inch in diameter, and lined with what appeared to be an adventitious cyst wall formed of effused lymph. They were coiled up together in tangled masses and surrounded by pus. In the first case the worms were coiled up in a mass, but no cyst wall was noticed; allowance must however be made for the fact that the tissues had been macerated for some time, previous to dissection, in a strong acid solution. One of the cysts contained two worms, a male and a female. Another cyst contained a solitary female. In the other instances the numbers contained in each separate cyst were not determined. Some of the worms were broken in the attempts to disentangle them, and hence it is not quite certain what the total number, discovered in the three cases, was; but twelve females and five males were counted.

In the first two cases the worms were either contained in lymphatic vessels or were in close relation to them, but in the third case they were situated in the interior of lymphatic glands. The latter is a fact not previously observed and bears, as we shall see, an important relation to the pathology of certain forms of filarial disease, and, more especially, to their treatment. A consideration of these facts appears to warrant the following conclusions, *viz.*: (1) that the worms may be found, not only in the lymphatic vessels, but also within the lymphatic glands; (2) that they lie coiled up in tangled masses which are enclosed, under pressure, within small cyst-like cavities; and (3) that each cavity may contain one or more worms.

Passing to a consideration of the lesions which result from the presence of the filariæ we find one or two interesting points for discussion. In case No. I there was a blow on the arm which probably killed the filariæ, and an effort was then made by the tissues to throw off the offending bodies by setting up inflammation. In case No. II the parasites died and their dead bodies gave rise to inflammation and suppuration, but the cause of their death, in this case, was obscure. That certain diseases of the host have an influence upon the filaria is evidenced by the fact that periodicity in the appearance of the embryos in the blood is disturbed by the febrile condition. It is also not improbable that some drugs, such as quinine and mercury, have an effect upon them. It is not uncommon to find that the onset of elephantiasis has been coincident with an attack of syphilis, and indeed many of the old writers ascribed the disease to syphilis. May not the syphilitic virus, or some of the remedies used for its cure, cause the worm to abort, or even cause its death? In case No. III the natural assumption would be that the enlargement of the glands was caused by the parasites contained within them It might be said on the other hand that the fact of the glands being enlarged on both sides of the body pointed to the probability of an obstruction high up in the lymphatic system; the dilatation of the lymphatics in the groin being merely part of a general distension of the whole lymphatic system situated above the glands If this were the case however we should have found that the lymph contained in the groin glands was chylous in character. This was not the case, nor were there any indications whatever of general dilatation of the lymphatics of the trunk. This point, as we shall presently see, has an important bearing upon the question of treatment. It seems reasonable on the whole to assume that the changes in the glands in this case were due to the parasites contained with them; the direct cause probably being plugging of the ducts by prematurely discharged ova.

Let us now pass to a consideration of the all important subject of treatment. Do the facts that have been brought to light by these and other cases afford us any indications as to treatment? Five years and a half ago a young man, whose case (No. IV) has already been alluded to, came under my care, suffering from varicose glands of the groin, and on examining his blood filariæ were found. He suffered from frequent and severe attacks of pain and fever, so much so that he was unable to follow any occupation, and he begged for something to be done to afford him relief. In thinking over his case it struck me that the parasites might possibly be situated within the diseased glands themselves, and that, if this were the case, removal of the glands might afford the patient relief from further trouble. When this suggestion was made to the patient he readily consented to an operation being undertaken. The mass of diseased glands was accordingly removed by operation and the patient got well. Five months afterwards a swelling appeared in the opposite groin, but there were no more attacks of fever and pain, and he was, and still is, able to carry on an active life in the mercantile profession. The mass of glands that was removed was unfortunately lost, and no opportunity obtained for examining them, so that it is impossible to say whether any parasites were present within them or not. The satisfactory result of the case however seemed to justify the hope that similar operations might be of benefit in other cases of filarial disease, and the recent discovery of filariæ within the diseased lymphatic glands, in a case very similar to the above, appears to afford an additional justification of the operation.

Certain French surgeons who have investigated the question are opposed to this operation on the grounds that it is very liable to be followed by septicæmia. But such an objection can scarcely be considered a valid one in these days of antiseptic surgery.

In advocating operations for the removal of diseased lymphatic glands in cases of filarial disease, I would, of course, exclude all those cases in which the local lesions are manifestly merely a part of a widespread dilatation of the lymphatic system, due to an obstruction situated high up in, or near, the thoracic duct. Manson's experience lead him to believe that very many, or nearly all, cases of varicose groin glands belonged to this class ; as evidenced by the fact that the fluid contained within them was chylous. Our experience in Madras is opposed to this. I have only seen one case in which there was a suspicion of the obstruction being seated at all high up, and no cases in which chyluria had ever occurred. Putting aside such cases as these, it seems to me that there are a considerable number of instances in which operative treatment promises to be of service in mitigating, if not in curing, the disease.

These cases may, for the sake of convenience, be divided into the three following classes : Firstly, *cases in which the lymphatic glands are enlarged and varicose and in which filariæ are found in the blood, but where the diseased condition is not part of a widespread dilatation of the lymphatic system.* When we meet with such a case, and the patient suffers from frequent attacks of fever and pain, which seriously disable him, and render him unfit for any active occupation, I think we should recommend an operation. The experience furnished by the case already related shows that very great relief may result from removal of the diseased glands. Whether we should operate on cases in which similar lesions are present, but which are not attended by any suffering or inconvenience, is another question, and one that cannot be definitely settled until further experience has been gained.

The case alluded to as No. III may be considered an example of this class, and furnishes evidence in favour of operation. The patient had varicose glands in both groins and many filariæ in his blood, but he was not suffering from pain or inconvenience. Nevertheless the presence of the tumours, and the knowledge of the cause of his disease, caused him great mental anxiety, and he was anxious to undergo any treatment, operative or otherwise, which offered a chance of getting rid of the parasites. On the day following the operation all filariæ disappeared from his blood, nor have any been seen since then, although a period of three months has elapsed. These facts favour the belief that all the parasites have been removed, and that the patient has been delivered from all chances of future trouble. Too short a time has elapsed to enable us to say more than this, but the case appears to furnish strong evidence in favour of operation.

The second class of cases are *those in which, although the glands are enlarged and varicose, yet there are no filariæ in the blood.* Cases belonging to this class are not at all uncommon. During the past eighteen months I have operated upon three such cases, two of which have already been alluded to as Cases IV and V. The fact that there are no filariæ in the blood does not show, as Manson long ago pointed out, that the disease is not of filarial origin, but rather that that part of the lymphatic system, which is inhabited by the parasite, is shut off from all communication with the blood by blocking of the passages. When such cases are accompanied by much suffering an operation may afford relief. The probabilities are that the dilatation of the lymphatic channels is purely local, and the operation is not attended by any special danger. It is unfortunate that two out of the three cases alluded to have been lost sight of and the result in these instances not known. In the third case I regret to say there has been no benefit whatever up to this time. The failure appears to be due to the operation not having been a sufficiently radical one. The femoral glands alone were removed, whereas the inguinal glands appear involved in the disease, for pain is now felt in the latter and they have become swollen. It is a question whether we ought not to recommend operation in all cases of this class, no matter whether there are attacks of pain or not. If, as we have grounds for believing, filariæ are present in the glands, there is always a possibility of some further development of the disease taking place, unless this be prevented by timely extirpation of the glands along with the parasites concealed within them.

The third class of cases are those in which, under ordinary circumstances, there are no indications of filarial infection, but in which, owing to causes that may or may not be evident, inflammation is suddenly developed in that part of the lymphatics that is inhabited by the parasite. Examples of such cases are those alluded to as Nos. VIII and II. Cases of this nature are not uncommon, and I have met with several others besides those related in this paper. It is probable that in many cases the worms are dead ; still we have no certainty of this, and when the part affected is easily accessible it is better to make an attempt to remove the parasite.

These are the three classes of cases in which it seems justifiable to hope that operative treatment may, in some instances, be a means, not only of alleviating the disease, but possibly of curing it.

Before concluding this paper I should like to draw attention to one or two points connected with the operation for removal of elephantiasis of the scrotum and penis. The difficulty of covering in the structures, laid bare during this operation, has led to the suggestion of a variety of procedures for effecting this object. At one time it was the practice to preserve portions of the scrotum as flaps to cover in the testicles, but the result of experience soon proved the uselessnes of such attempts, and the light shed upon the pathology of the disease has served to demonstrate the cause of such failures. This procedure is fortunately unnecessary, because we can attain the same end by different means, and the testicles can be easily and effectively covered in by skin taken from the thigh. This is effected as follows : The scrotum having been completely removed, the skin on either side of the wound, that is to say, the skin of the thigh, is dissected up from the subcutaneous tissue for a distance of two inches opposite the centre of the wound, and to a lesser extent above and below this point. The patient's thighs are then approximated, and the two portions of skin easily united with one another in the middle line, completely closing in the testicles and embracing the root of the penis.

Various methods of covering the penis with flaps of healthy skin have been tried but none have proved satisfactory. I have for some time past practised Thiersch's method of skin grafting, and strongly recommend this procedure as one which expedites the healing of the wound, and to a great extent prevents that contraction of the penis, which always results, unless some such measure is adopted. The procedure consists in the application of a number of skin grafts, at the time of the operation, and is carried out as follows : Several long strips are cut from the anterior surface of the thigh, the skin of which has been as thoroughly purified as possible. The section of the skin should be made deep enough to include the tops of the papillæ, but no deeper ; and after the graft has been stripped off, a white surface should be left, dotted over with minute drops of blood. The strips of skin are next divided into portions about half an inch square and laid smoothly on the surface of the penis, so as to cover the whole organ, which is then covered with a dressing of boric acid ointment, fastened so securely as to avoid any chance of its slipping. If the grafts are cut of a larger size than those described they are more apt to become displaced than if smaller ones are used.

CONTAGIOUS PEMPHIGUS.

BY SOORJEE NARAIN SINGH,
Assistant Surgeon.

PEMPHIGUS is described in text-books as a non-contagious skin disease. I have, however, seen cases which occurred one after another in rapid succession in the same family, as also by communication in neighbouring families.

In August 1893, while in consultation with Surgeon-Lieutenunt-Colonel E. Bovill in a case of club-foot in a new-born child, I noticed pemphigus on the body of the child. Dr. Bovill suggested to me to keep a record of such cases as could be found to have run on in the same family. Since that time I have had opportunities of seeing cases of pemphigus in three families in which it affected several children in quick succession.

Family I.—In this family there were seven cases, all occurring within a period of from 5th to the 20th August 1893, and in children aged from 14 days to six years. In these cases the bullæ varied in size from a large pea to a hen's egg, and contained a clear fluid which gradually became opalescent. Some of them burst in a day or two, sometimes earlier. In those that burst, the cuticle would curl up at places, exposing the red, raw surface underneath, and forming a slightly yellowish crust. In those that did not burst, the cuticular wall shrivelled up, forming a thin white crust, which in a short time withered away. The mark left on the body would appear a faint pink white for a few days, but afterwards there would be no trace whatever on the skin. There would be no pit or cicatrization. In the cases I examined, I found that no sooner was one set of bullæ on the decline than another set would crop up, and so forth, for a week or two, sometimes extending to three weeks. The bullæ were all separate, and none of them coalesced. The eruption at first appeared as small red spots, which rapidly formed into blebs. The bullæ were generally found on the hands, legs, and back. There was little or no fever, only a slight constitutional disturbance being present, such as loss of appetite, slight emaciation and general uneasiness, probably from the pricking and smarting pain of the bullæ.

Family II.—In this family there were three cases of pemphigus also occurring in children, aged from 11 months to seven years, and within a period extending from the 10th to 26th September 1894. All these cases were of a similar nature to those in the foregoing family.

Family III.—In this family there were two cases occurring on the 19th and 29th October 1894, and in children aged two years and two months, respectively. It is a remarkable fact noticed even by the lay members of the house that one of the three children of family No. II, the one aged 11 months, had been brought by her mother to this house, and a few days after the child, aged two years, of family No. III (who in all appearance was a very healthy girl) was affected. This case was exactly of a similar nature to those described in family Nos. I and II. The second case of this third family was, however, of a very grave nature and terminated fatally. The little infant, aged two months only, had been under homœopathic treatment for diarrhœa. When I was called to see it, I found a big bladder filled with clear serum on the upper part of the abdomen, extending from the splenic to the hepatic region, and breadthwise from the epigastric to within an inch above the umbilicus. There were big bullæ also on the groins, the chin, back, arm, legs and ankles, all rapidly distending themselves and bursting, the surrounding skin remaining perfectly healthy. The child was in great agony, constantly crying; fever high—103° F. Some of the bullæ had burst, exposing the red corium. The discharge from the bullæ was of a fœtid smell. In short, the child looked, as it were, scalded all over. The child had been in a bad state of health from birth, suffering repeatedly from indigestion and diarrhœa.

I give a table showing, in all my cases, the consecutive order of the date of attack, duration of the disease, and the inter-relation of the patients affected.

On the whole, if I am to analyse all these cases I saw during the last two years, I am inclined to think that pemphigus, at least in the certain forms I have had opportunities of examining it, is of a contagious nature. In family No. I and in family No. III, the disease could be traced to have occurred by communication with persons suffering from the same disease in the neighbourhood, while in the same family it spread amongst the children very rapidly. I cannot say that the disease could be in all these cases the result of a certain condition of the system, such as are occasioned from bad health or insanitary living. The cases I examined were, although not models of health, yet except one quite as healthy as native children ordinarily are, and living in houses and localities not particularly insanitary.

While I was examining my cases, I had my eyes open regarding any mistake as to diagnosis. I was sure my cases could not be mistaken for a varicella. Even the smallest bullæ were larger than any varicella vesicle, and the large bullæ or the bladders in my cases have no comparison with varicella. The succession of crops of bullæ in the cases I examined continued to two or three weeks, whereas in varicella there is generally no fresh crop after a week. In varicella there is always left in the skin, for a considerably long time, a whitish blue stain, which may also be pitted or cicatrized. In my cases after the cuticular wall crumbled, there was no pitting, and the pink white skin left, lasting only for a few days, would leave no mark whatever. In varicella, again, there is often an ulceration before cure. In my cases there was no ulceration, except in one, pemphigus gangrenosus. My cases could not also be mistaken for varicella bullosa, because they had rapidly enlarged and fully distended before bursting, whereas in varicella bullosa the vesicles do not generally enlarge until they have burst, and they generally enlarge at the periphery of the crust. There was no case of chicken-pox in the neighbourhood at the time I saw the cases of pemphigus.

I find the question whether pemphigus is or is not contagious has of late attracted the notice of some doctors in Europe.

In conclusion, I beg to apologise for making any assertion contrary to the teachings of the text-books; but I leave my experiences to the Congress with a view that the question may be investigated.

Table showing the cases of pemphigus from August 1893 *to November* 1894.

No. in the consecutive order of attack.	Age.	Sex.	Inter-relation of patients.	Date of attack.	Duration.	Character of the disease.	Resu
Family	I.						
1	2½yrs.	F.	A neighbour and frequent visitor.	5-8-93	Days 19	Pemphigus Diutinus (acutus)	Cured.
2	4yrs.	M.	Son of the head of the house.	7-8-93	16	Do.	Do.
3	6 ms.	F.	Daughter of the head of the house.	8-8-93	15	Do.	Do.
4	6yrs.	F.	Do.	8-8-93	18	Do.	Do.
5	2yrs.	F.	Do.	10-8-93	16	Do.	Do.
6	2½yrs.	F.	Niece of the head of the house.	11-8-93	18	Do.	Do.
7	14 days	F.	Grand-daughter of the head of the family.	20-8-93	16	Do.	Do.
Family	II.						
8	11 ms.	F.	Daughter of the head of the house.	10-9-94	20	Do.	Do.
9	5 years and 7 months	M.	Son of the head of the house.	18-9-94	15	Do.	Do.
10	7 yrs.	M.	Do.	26-9-94	21	Do.	Do.
Family	III.						
11	2 ms.	F.	Daughter of a son of the head of the house.	29-10-94	6	Pemphigus gangrenosus	Dead.
12	2 yrs.	F.	Daughter of another son of the head of the family.	19-10-94	More than 2 weeks	Pemphigus diutinus (acutus)	Cured.

DEMONSTRATION.

Gimlette (Sutna) showed a peculiar specimen of lipoma removed from the back of an old woman where it had remained for forty years. In the centre of the tumour was an irregularly shaped nucleus of bony hardness. The broad base of this nucleus was to the side of the spine, but overlapped it in the ordinary position of the tumour. Careful manipulation showed that it had no connection with the spinal column. After removal of the growth the bony mass was found to lie loosely in the fat, which composed the bulk of the tumour. Although clearly defined and easily separated it had no enclosing capsule. The impression it gave was that it was actually bone. On section however it looked more like calcified fibrous tissue and did not have the cartilaginous appearance which old lipomata at times present.

SECTION
OF
PUBLIC HEALTH.

PRESIDENTIAL ADDRESS.

BY W. G. KING, D.P.H.,
Surgeon-Lt.-Colonel, I. M. S.

On first being informed that the Health Section of this Congress had done me the honour of electing me President, I necessarily felt doubt as to whether I ought to accept so responsible a position for which I cannot help feeling I am ill-fitted. I, however, understand that our Bengal brethren, with whom the happy idea of the holding this Congress originated, have, as far as possible, reserved for their visitors all posts of importance. It is thus I find myself possessed of the pleasure of being the first President— let us sanitarians say whilst at a safe distance from enthusiasts in other branches of our glorious profession— of the most important Section of the first Indian Medical Congress. Allow me, Gentlemen, to thank you sincerely for the honour afforded me, and, if I may be permitted to so regard it, the Presidency in which I have the privilege to serve.

Although this is the first Medical Congress in this country, it is doubtless not the first time that wise heads have been shaken in the discussion of matters sanitary. The laws of Manu could not have seen the light, unless there had existed in ancient India a section of the educated classes who regarded sanitation as of so great moment—that, to bring it home to the masses, it was desirable to weld its laws with their religion. None but men possessed of strong sanitary instincts would have considered it necessary to render it illegal that filth should be brought near them, or would have taken care that those following noxious trades, and the "great unwashed" generally should not approach them. It is true these sanitary laws are known as "rules of caste," but neither their origin nor intention can be mistaken. Were the most recent refinement of scientific research—the bacteriologist—to have it all his own way, I verily believe we should find ourselves bound down by rules as rigid as those of caste ; none but men who, on penalty of excommunication from the guild, were in the habit of completely washing their bodies and clothing a certain number of times daily, and who would undergo special purification and a stage of segregation, if, by force of circumstances, brought in contact with unkindly microbes, would be permitted to handle our drinking-vessels or prepare food for us. We should find it necessary to purify ourselves carefully after our chins had been handled by the barber, or we had attended a funeral ; we should all be bound to prevent saliva, excrement, blood and other defiling matter reaching our public water-sources ; we should regard sunlight and the "living earth" as the great purifiers. Laws such as these must in their day have been of vast benefit to the members of the guilds which were called upon to live in the midst of an alien, and, apparently, not over-cleanly race.

The Hindoos, however, by no means possessed a monopoly of a belief in sanitary laws. Mahomedans brought with them the dicta that "cleanliness is the key to heaven," and that "the preservation of the life of man is but second to the command of God." In this matter, they did not halt at mere theory, as witness the magnificent infiltration galleries, and the distribution of enormous volumes of pure water in pipes under pressure in Aurangabad, Ahmednugger, Berhampur, and other localities. In proof of the fact that these works, designed by the Sanitary Engineer of the period before cast-iron pipes had been dreamt of, have fulfilled their function, I may mention that the city of Aurangabad—although the protection of its water-supply is by no means perfect according to modern notions—has, during the three hundred years of their existence, been remarkably free from cholera. Indeed, it frequently occurred that, whilst the neighbouring British Cantonment suffered severely, the city of Aurangabad, within a mile of it, remained fairly free. The reason for this comparative immunity being self-evident, in that in the one case a much-defiled stream is the water-source, in the other a partially-protected supply from a good orgin, the enlightened Government of H. H. the Nizam latety sanctioned the opening of water-works for the cantonment. It is a curious commentary upon the principles pursued in these ancient sanitary engineering works that Mr. Marrett—the able Engineer for the modern works—has also drawn his supply from infiltration galleries, the data as to the yield of which he was aided in calculating by an examination of those formed three centuries ago by Malik Umber and Aurangzebe.

But it has been with Hindoos and Mahomedans alike, as it has been with the Jews—the other instance where hygienic laws had been knitted to religion—the letter of the law has been fulfilled, but the spirit has been forgotten ; thus, alas, the India of to-day is a byword amongst the nations as to neglect of sanitation, and is regarded as the home of that much-dreaded pest —cholera ! Hence, it is in this country, there exists an enormous field for the labours of that modern branch of the medical profession which we recognize as sanitation. Well may the qualifying term of modern be applied to this science of the West, when compared with the rules of caste of the East with which there is so much akin. The great cholera scare in Great Britain of 1849 pointed to the necessity of concerted public action where grave epidemics were feared ; the waste of human life and hardships to which our troops were subjected in the Crimea taught the public the necessity of attending to the warning voice of Hygiene. As you all know, the outcome of this movement was a demand that our soldiers, when called upon to risk their lives for their country in fair fight, should not be condemned to die by disease born of filth and engendered by ignorance. This was responded to by the appointment of a Royal Commission, and the founding of the Army Medical School at Chatham and, subsequently, Netley. When quiet times succeeded the troublous days of the Indian Mutiny, officers trained in these schools at the feet of that noble and learned man, the late Professor Parkes, could not fail to be imbued with his unselfish spirit, and thus whilst, on the one hand, they toiled in the various civil stations to which they were attached to start medical institutions, on the other, they did not forget their duty as sanitarians. They formed Sanitary Committees whose constant representations to the authorities as to the condition of the civil populations resulted in the birth of Municipalities and Local Fund Boards, charged with the sanitary administration of urban and rural areas, respectively. Under their care, also, rose great medical schools, which have afforded training to the important class of private medical practitioners which now shares with the Indian Medical Service the responsibilities of medical and sanitary work in this country, whom we have the pleasure in this Congress of welcoming as valued colleagues capable of aiding us with their experience and advice, in the common object of sanitary reform. These advances were made but slowly, but, during the last fifteen years, the progress of hygiene has been in geometrical proportion. Investigations in the various sciences which go to make hygiene are now pressed forward with feverish haste, and we no longer wait till the experimenter has settled with his publishers as to a book to see the light perhaps a year after completion of his work ; we demand that intelligence shall be sent us by wire, and brook no delay in being told that Koch has discovered the bacillus of tubercle ; Klein the streptococcus of scarlatina ; Pasteur an inoculation against rabies, and Haffkine against cholera ; that Hankin has demonstrated a new tox-albumin, and Simpson the true origin of vaccine lymph ; that Manson has taught us to dread the mosquito, and Cunningham to think less unkindly of the comma bacillus ; that the lucid pen of Hart has stirred the length and breadth of the civilized world in demanding better sanitary care of the "home of cholera ;" and that Miss Florence Nightingale preserves intact her sympathy with sanitary advance in this country. Indeed, even the telegraph does not afford us sufficient facile methods for the interchange of information we now meet face to face that we may share with each other the fruits of our experience and labour.

The Royal Commission of 1863, to which India is so greatly indebted for its awakening into sanitary activity, declared that the mortality of the European soldier was equivalent to 69 per 1,000 amongst the men and 31 per 1,000 amongst the officers ; while in 1860-61 in jails for native prisoners the mortality was 67·0 per mille. I need not trouble you with a statement of what the mortality was amongst the civil native population, as our registration statistics were at that time, and are up to date, far too defective to enable trustworthy figures to be furnished. In accordance with the advice tendered by the Royal Commission, advising bodies were, in 1864, attached to each Government in the form of Sanitary Commissions. In 1866, these were replaced by single officers—Sanitary Commissioners. Under their advice, radical improvements were made in dietaries, in the buildings, and precautionary methods pursued in barracks and jails. The death-rate of the European soldier is now about 12 per mille from all causes, and that of our native prisoners about 29 per mille. These results are undoubtedly highly satisfactory, and can be ascribed to no other cause than the placing of the populations concerned under improved hygienic conditions.

In regard to jails, although here and there minor insanitary conditions still exist, it may fairly be said that, as to diet, labour, and dwelling accommodation, the native prisoner is well off. I do not believe the same can be said so fully either of the British soldier or Native sepoy. The period of progress inaugurated in 1864 has not been continuously maintained. Typhoid fever claims far too many victims for it to be imagined that the surroundings of the British soldier are free from reproach. I do not forget that Thomas Atkins has his own little ideas of what is good for his internal economy, and imbibes, without thought of its origin, vile "cool drinks" prepared for him in the bazaars ; but we cannot well regard this—albeit preventible cause—as sufficiently explaining our losses. In the matter of food supply, which demands the special knowledge, not of the medical man only, but also of the chemist and analyst, our Army authorities have become impatient of control or suggestion by the medical profession, and we find the modern tendency is to attempt to educate military officers to do the work of the sanitarian ; so that, except at the expenditure of much representation and the risk of considerable opprobrium, it is impossible for the medical officer to reject that which the combatant officer officially responsible for food inspection has already passed. It is highly desirable that military officers should possess the training indicated, just as it is also desirable that medical officers should have sufficient military training to defend the wounded or themselves in desperate positions, as they have so often managed to do without possessing that advantage. But, whilst I would demand that in action the lives of soldiers should be entrusted to professional combatants, it seems but meet that all matters affecting health should be under as complete control by the sanitarian as the exigencies of military service would permit. Recent reports by officers of the Army Medical Staff have shown that the dry-earth method of night-soil disposal in certain cantonments is far from above suspicion. Nor, in the more grave matter of water-supply, have our cantonments, in the generation that has elapsed since the appointment of the Royal Commission, been placed in completely satisfactory condition. In two at least of our important military stations in the Madras Presidency, the water-supply is such as to leave little room for doubt that, however much the soldier is himself to blame in contracting typhoid by his gustatory peculiarities in the midst of the bad hygienic conditions of native bazaars, there is ample room for his contracting the disease nearer his barracks.

In Bangalore, the troops are provided with water from a tank which is supplied by an open channel that passes through a native bazaar, but is duly kept clean by means of sweepers, whose services, be it noted, are considered necessary. Forming part of the wall of the supply channel is the main sewer from the same area. This sewer is ingeniously arranged, so that when over-charged with storm water—brought thither by open drains which are destined normally to receive the sewage from native houses—relief is obtained by discharge into the water-supply channel, and thus into the tank. We are consoled by the statement of the Engineer authorities in charge that overflow only occurs about five times per annum! Again, in Madras, the so-called "Seven Wells" water is supplied to the British troops. This water has been pronounced "bad" by the Madras Chemical Examiner, whilst a sanitary survey shows that enormous collections of rubbish containing fœcal matter deposited by the Municipality, sewage farms, and graveyards, are within the same sub-soil sheet as the source. Both in Bangalore and in Madras the British troops have suffered from typhoid fever. They are said to be valued at £100 per man.

But there is one class of disease to which the British soldier is subject, which, in the plenitude of the wisdom of Exeter Hall, it has been determined prevention shall not be exercised. In India, during 1892, there were inefficient for certain periods during the year 27,000 men, or 410 per mille of the average strength, by reason of admission to hospital for venereal disease; and 208 were invalided from this cause during the year. Yet, by the repeal of certain clauses of the Contagious Disease Act, the hand of Government has been stayed at the instance of a narrow-minded section of the British public. In the name of morality, in the name of Christianity, the erring bachelor has been dealt with on the "serve-you-right" policy—possible only of adoption by minds devoid of the power of recognizing in what true humanity exists. To what punishment would not these purists condemn the man who, having warned his child that if he played with fire he would burn himself, complacently saw it commit the act of disobedience and be literally done to death; yet, the policy of non-interference entails present suffering in our fellowmen and their companions in immorality from a disease that may be transmitted to a wife and the innocent infants of a future union. I know of no law of God or man that can give countenance to a policy so cruel. The only possible excuse that can be offered for the leaders of this movement is that they hoped that fear of acquiring disease would act as a deterrent. In this they have exhibited gross ignorance of the laws of Nature; not the biggest scarecrows ever made—and the soldier is aware that the dangers are real enough—would quench human passion. Neither can it be pleaded that the measure protects women from falling. On the opposite, a system of supervision prevents many from subjecting themselves to degradation so manifest, and must often have saved those from final ruin whose wings have been singed. In my opinion, the result of the repeal of the law has been to extend the circle of immorality, and to bring within the area women who might otherwise have escaped. Nothing short of the moral training that would demand that mankind be "temperate in all things" can afford the result arrived at, and it is to this end, combined with endeavours to make gymnastics and all manly exercises receive far more encouragement than at present at the hands of the authorities, all efforts should tend.

The sanitary conditions under which the Native troops serve are certainly much superior to those of the average civil native population, and, undoubtedly, the small mortality, and especially their comparative freedom from small-pox and cholera, exhibit the results of the supervision exercised. But, in respect to native followers, there can, I think, be little doubt that defects exist. An army wasteful of its transport animals must suffer seriously in the long run, to say nothing of the enormously increased cost to the country employing them. The last Afghan war seems to have taught the necessity for care in this particular, and officers and men now receive training as to loading and unloading that was before little thought of. But I have failed to see any precautionary measures suggested, or adopted, as a result of the loss of life amongst native followers which occurred in the various expeditions of late years in Burma. I cannot here take up your time with details, but I would ask those who have interest in these questions to balance the diet, fuel allowance, and shelter provided for followers, against the work expected of them as weight-carriers on lengthy marches, and compare these data with those applicable to native combatants employed side by side with them, and ascertain for themselves whether there does not exist some physiological error, which in part accounted for the invaliding and death-rate of that useful class of men. In my humble opinion, these matters should have been carefully sifted, and the medical and sanitary experience, gained from our little campaigns in Burma, should have been made available for possible heavier struggles in the future.

In the case of troops and jails, it is but demanded that the sanitarian should convince the ruling authorities as to the necessity for action, for the latter to find fund and issue orders. With the civil population, the problem is, however, much more complex. It embraces questions as to the sanitary discipline of 212 millions of people inhabiting the most diverse climates, speaking different languages, possessed of different customs, and, above all, bound hand and foot by prejudices which they are but too apt to confuse with religious instincts. Undoubtedly, the foundation of all sanitary efforts must be the existence of suitable laws to support the sanitary executive. Since 1863, we have seen passed laws under which Municipalities and Local Fund Bodies have sprung into existence; these, in their infancy, were largely controlled by Government officials, but of late years, under the Local Self-Government movement, have been placed in the hands of representative native gentlemen. In the case of the Madras Presidency, the Act dealing with the rural tracts has already, since its inception in 1871, undergone one revision, and is now being remodelled by Government. The same is to be said of the District Municipalities Act. For the large town of Madras, revision of the special Act applicable has also been accomplished. These alterations were largely prompted by the necessity for increased sanitary procedure. In regard to Fairs and Festivals, increasingly stringent regulations have had some influence in diminishing the appalling loss of life, which the insanitary conditions under which most of them used to take place brought about; but on this point, much remains to be done. Careful records of factors affecting the health of populations, as to the progress of epidemics, and sanitary subjects generally, may be reckoned by the lakh. Attempts to ameliorate existing conditions by petty expenditure, and the giving of advice have also everywhere been made in our rural tracts and minor towns. The Vaccination Department has not been idle, and has made its influence felt upon mortality distinctly; but no one has yet been able to convince the Government of India that the employment of a poorly-educated and ill-paid vaccination staff throughout the country is incompatible with the attainment of full results. In rejecting a scheme for employing medical subordinates in the Madras Vaccination Department in 1868 the Government of India informed that of Madras that "the duties" of vaccinators "are purely mechanical," and the rates of pay proposed "are needlessly high from a desire to attract men of education and respectability such as are not required, inasmuch as they would be more expensive agency than is requisite for the purely mechanical duties of viccinators." During the last 6½ years in the Madras Presidency 201,394 deaths were registered from the preventible disease of small-pox. Taking into account the probable number of survivals from these attacks at 64·3 per cent., it is calculated that—without taking into account the capitalized value of lives – there must have resulted during sickness and upon funeral ceremonies an unproductive expenditure of 51 lakhs of rupees, if it be presumed that the persons attacked occupied no higher position than the coolie gaining Rs. 5 per month.

But in the practical application of sanitation outside the limits of the capitals of the various Governments, our advance has been but little. Unfortunately for the country, it was possible for those responsible for this absence of progress to shelter themselves behind a motto that was so frequently applied to the Sanitary Department that it became a part of the sanitary creed of the day. There were, it was repeatedly stated, prejudices to overcome; therefore *festina lente* must be the guiding principle. The phrase saved much labour, and it became the business of no one to enquire whether these prejudices really were of so serious a nature as to clash with the people's more deeply-seated and legitimate opinions of religion, and—it saved money. Year after year, it was pointed out that if the principles evolved from the investigations of the sanitarian were to be given effect to, specially-trained Engineers to execute sanitary schemes, in consultation with Sanitary Commissioners, were requisite. At last the Secretary of State acted upon these recommendations, and the majority of local Governments are now provided with Sanitary Boards having a Sanitary Engineer as a member. Further, the important principle that Government must aid sanitary advance by direct allotment of funds has now been conceded, and local Governments are responding to the call; in the Madras Presidency, the Government has, since 1890, in the manner of free grants to Municipalities, given the sum of Rs. 13,05,850, besides advancing loans upon very favourable interest to Municipalities for drainage and water-works. 1888—the date of the Secretary of State's Despatch on these subjects—may well be reckoned a new era in the sanitation of India. Since this period we have seen the North-West Provinces busy in the revision of its sanitary laws, especially with reference to the accommodation of pilgrims; a Village Sanitation Bill has been essayed in Bombay; and Bengal, under that ardent sanitarian, Sir Charles Elliott, has excogitated large drainage schemes that, aided by legal measures, are directed against the greatest cause of mortality in this country—malaria: these are measures of the most practical nature which must be far-reaching in their life-saving results. We have seen a well-known bacteriologist appointed at Agra, and to the Sanitary Commissioner with the Government of India a special assistant for bacteriological enquiry has been attached. Methods of intercommunication between presidencies and between neighbouring districts as to movements of epidemics have been successfully organized In numbers of the larger towns drainage and water-supply works are in actual progress. But it would be folly to consider there have been made efforts commensurate with the great work of life-saving before us.

Although, as I have shewn, it has been possible within the last few years to throw off something of the glamour of that thread-worn proverb, there is still enough of the old spirit of *festina lente* prevailing to clog the wheels of progress, and to limit the fuel, the consumption of which makes the machinery exhibit its full value. I refer to that useful article—money. Schemes for sanitary improvements are still built toilfully, yet, in hope are launched upon seas of unbelief, and are wrecked upon the shores of finance. In short, sanitary advance is constantly frustrated by the cry "no funds." In this great assembly of sanitarians representing opinions from all parts of India and of Europe, we may well be permitted to ask without being taxed with captiousness, or, in the case of those occupying official positions, insubordination, whether it really be that no funds are available, or that Government has not yet arrived at a sufficient grade of faith in sanitation to devote to it its fair share of funds. I maintain that sanitation neither receives its fair share of funds, nor that place in the government of the country it merits.

I have had no time to enter into statistics on this subject in other Presidencies, but taking the case of Madras, I find that from Provincial Funds the average amount spent directly upon sanitation during the last five years was Rs 44,660 or 0·15 per cent. of the total funds. This expenditure is for a Sanitary Commissioner aided by a single Deputy, who also, under the former officer, is in the charge of the Vaccination Department, *plus* an office staff. This represents the total staff devoted solely to sanitary purposes and paid from Provincial Funds, for the care of about 36,000,000 people and an area of country about 141,189 square miles. But for education during the same poriod, it was found necessary to allow an average of Rs. 12,21,230 per annum or 4·1 per cent. of the total funds. It is further noteworthy that, whilst expenditure on the sanitary staff remained practically at the same figure for education, it has year by year steadily increased, so that although, in 1883-84, Rs. 9,52,778 was thought sufficient, in 1892-93, Rs. 14,06,352 was demanded. This sum includes grants to local bodies and the pay of a Director of Education, who gets a salary of Rs. 2,000—2,250 per month, has a suitable office staff, *plus* an admirable staff of assistants in the form of Inspectors, Assistant Inspectors and Sub-Assistant Inspectors, male and female.

In this statement of expenditure from Provincial Funds, no account is taken of grants for buildings for educational purposes, which in the Presidency-town alone cost Rs. 13,34,355. The Government has remained so convinced as to the necessity for this outlay, that it has felt it desirable, in the interests of economy, to issue its orders from an ancient building, which is a cross between a barrack and the office of a commercial firm—affording a decided contrast to the magnificent educational buildings, such as the Presidency College, the Senate Hall, and Law College, which are in its proximity. Even were the provincial grants to Municipalities I have mentioned taken into account, the percentage from Provincial Funds for sanitary works and sanitary staff would amount to 0·57 against 4·1 for education, excluding grants for works and buildings.

Nor does the Educational Department cease its demand for money only from Provincial Funds. It duly asks and receives its share from Municipal and Local Funds. I find that, in 1893, the Educational Department spent from Provincial and Local Funds Rs. 21,32,281 against Rs. 7,88,000 devoted to sanitation, or a proportion of 5·4 per cent. against 2·0 per cent. of the total funds. On combining the figures for Provincial Funds, Local Funds and Municipalities, it is found that education consumes 5·5 per cent. against 3·0 per cent. for sanitation. As far as it has been possible to effect this from the data available, this sum represents net expenditure. The amount spent in sanitation represents the maintenance charges for conservancy staffs and the up-keep of plant for a population of 36,000,000.

There are doubtless other departments which also receive more than their fair share of available funds, and thus tend to render sanitary advance impossible; but I have utilized this instance, as the Educational Department of Madras has long been subject to the well-merited criticism of over-production, whilst, like Oliver Twist, it for ever demands more. In the Madras Presidency, notwithstanding the popular opinion outside our limits that we are "benighted," the land is flooded with B. A.'s and Vakeels; or, in other words, with educated men. The best evidence of over-production is the market value of any article, and I may state that the finding of employment of any sort for University graduates is so difficult that they willingly accept posts on pay little better than that of a good class of domestic servants, whilst with Vakeels the earning of a living in strict accordance with legal ethics is becoming increasingly difficult, notwithstanding the extraordinary fondness of the people for litigation. But it may be said that education is the best ally that hygiene could have, and but paves the way for sanitary advance. Well, I have carefully watched results and have attempted to believe that this is so; but I am driven to the conclusion that this theory must be accepted with reserve. Whilst, doubtless, education has given to us in every part of the country consistent and earnest advocates of sanitation, in a large number of cases practice and theory do not go hand in hand. The average educated man will not scruple in the morning to proceed to the river side or tank, and perform there his complete toilet, using water that he sees is undergoing contamination within a stone's throw by his male and female relatives; although, in the evening, he will fully grasp the refined hygienic details of the evil results of early marriage, and will give his vote at crowded meetings as to the abolition of the nautch-girl. Not only has the Educational Department been guilty of over-production in the higher branches, but they have committed the fatal error of neglecting sufficiently to advance female education. It has apparently been forgotten how powerful and obstinate an advocate the female part of the population is of various superstitious customs. This neglect has rendered it almost impossible for educated natives to carry into their everyday life the practice of sanitation of which they have duly learnt the theory. In the mental culture of women I, therefore, think lies a far more legitimate field for the spending of public money than in the over-production of Vakeels and B. A.'s. But, irrespective of this great impediment, it is manifest that large as the number of educated men is, their influence upon the masses can be but small; where this can best be felt is almost solely in the large towns—the rural population representing the bulk of the people being practically beyond their sphere of influence. This mistake is beginning to dawn upon the public, and the Madras Government is now doing its best to favour primary and technical education—just where their predecessor's efforts should have *commenced.* This form of education, which will raise the status of the lower clases and assist in developing the long-neglected natural resources of the country, doubtless will effectually aid sanitary advance, and, were it to be understood that the new scheme is to be pushed forward by retrenching the useless expenditure upon over-production in the higher classes of education, the movement would have the full sympathy of those interested in sanitation. But there is every reason to believe that the changes incurred will form increased increments against funds that might otherwise be available for sanitation. If to "hasten slowly" has been the principle enunciated for the guidance of the Sanitary Department, "the people die not slowly, therefore be philanthropic and hasten their education," has been that unconsciously acted upon as regards the Educational Department.

In speaking thus, it must not be imagined that I would prefer not to see the country overrun with highly-educated men. Provided these gentlemen could get a living satisfactorily to themselves, their existence is a distinct factor in the advance of the country; whilst socially their mental culture makes acceptable comrades and friends of men, who would otherwise be incapable of exchanging an idea with their fellow-beings of the West; but I certainly think the time has come to consider, in view of over-production and the more pressing claims of the population upon Government for the preservation of health and decency, whether the higher class of education should not be secured by those desiring this luxury otherwise than at the hands of an elaborate department receiving pay and pensions from Government. I need not say we do not grudge our fellow-officials of the Educational Department the success which his attended their efforts, to persuade Government to give them so large a proportion of the sinews of war. The Sanitary Department has just as great opportunities to plead the cause of sanitation as they have possessed as to education; they have succeeded where we have failed. It is obviously to remedy this state of affairs that we must exert ourselves. If we believe in the enormous importance of hygiene in the saving of human life and suffering, we, as a body and as individuals, will not rest until we see this country provided with a better share of funds and a correctly-organized Public Health Department, capable of investigating and dealing with the causes of disease, and supervising and controlling the methods of expenditure upon sanitation. In undertaking to secure these ends we may well consider it our duty to press forward at the risk of being regarded by the public as mere "faddists" and men possessed of not the slightest comprehension of what the demands upon the State are. This, however, we can well afford to brook. We aim at securing no public praise, but at the attaining of the ample reward —even in a greater measure—for which our brethren engaged in medicine and surgery are willing to toil by night and by day: the pleasure of being the instrument in God's hands, of relieving suffering and saving life. For the sanitarian is reserved the joy, not of seeing the solitary weakly patient day by day gather strength to resist the onslaught of death, but of saving lives that may be counted by thousands; for him is reserved the happiness of seeing where before the unkempt street Arab revelled in filth appear a new generation in the full vigour of health, and where disease, poverty and vice reigned supreme, to find instead temperance, happiness, and wealth enthroned. Here is true philanthropy; to those who have felt this pleasure there can be no wonder that the ancient religions of nations, having little else in common, were united in finding a place for hygiene; for its first dictate is respect for the rights of our neighbours. It is thus that hygiene claims a fraternity from which neither Christian, Hindoo, Sikh nor Mussulman, Socialist nor Autocrat, can, with a clear conscience, hold himself aloof. Under the banner of hygiene, we are capable of knitting together every race and creed, because we labour for no selfish purpose—we endeavour to secure to man God's greatest blessing—health; we labour to preserve His most precious gift—life.

VOTE OF THANKS.

G. Hutcheson (Punjab) said: Mr. Vice-President and Gentlemen,—I have great pleasure in asking you to accord a very hearty and cordial vote of thanks to Dr. King for his able and instructive address. Dr. King's name is well known in India, and his method of preserving vaccine has greatly advanced the cause of vaccination in nearly every province of India, and the mention of his name will call forth the heartiest enthusiasm in the Public Health Section of this great Congress of the profession in India.

A. D. Mody (Bombay): In seconding the vote of thanks for the valuable address, I may say that our President is well known in the scientific world. His researches as regards vaccine are simply invaluable: by those researches thousands of lives have been saved. I have great pleasure, as a representative from Bombay, in seconding the vote of thanks, as especially as a member of the Bombay Municipal Corporation I am much interested in sanitary questions in India.

The vote of thanks was passed unanimously.

THE NEED OF A SANITARY SERVICE FOR INDIA.

BY W. J. SIMPSON, M.D., M.R.C.P., D.P.H.

INDIAN medical men have always taken an interest in the sanitation of those parts of India in which they have been stationed and have from time to time pressed on the attention of the Government the desirability of introducing measures for the removal of unhealthy conditions. These representations have invariably received careful and courteous consideration, and have been attended with considerable success, for to them are due, *firstly*, the vast improvement in the health of the army, which has taken place; *secondly*, the appointment of Sanitary Commissioners with its consequent recording of the health conditions of the civil population, the collection of statistics, the recent sanitary progress effected in large towns, notably in water supply, the spread of vaccination and the management of large fairs; and, *thirdly*, the appointment of Central Boards of Health in each province, all of which may be justly claimed by the Indian Government as achievements of no small importance, and on which they may be warmly congratulated. Not then forgetful of the past and of the advances which have been made under great difficulties, we medical men shall, however, only be following our old traditions when we undertake to point out the great defects in the existing system of sanitation in India and the measures necessary for further progress. And this is the purpose of the present paper.

There is no necessity of marshalling an array of striking statistics to prove the insanitary condition of the more advanced parts of India. That has been done many times previously, and it will therefore suffice in passing to merely bring to the recollection of the members of the Congress that in 1892, which is the year dealt with in the last report issued by the Sanitary Commissioner of India, there were in the European army 1,509 admissions and 376 deaths from enteric fever; and in the civil population out of over 7 millions deaths recorded more than ¾ million are ascribed to cholera and over 4½ millions to fevers. These are remarkable figures, and reveal in their own way the unhealthy state of the country. But to come down to a still later period than that of the Sanitary Commissioner's report, two events which have happened during the present year furnish startling evidence of the unsafe condition of the country in regard to health matters. One is the calamity that befell the East Lancashire Regiment stationed at Lucknow, in July and August, in which, notwithstanding every effort on the part of the medical officers, out of a total strength of 773 men 138 were attacked with cholera, of whom 92 died; the other is the disastrous outbreak of cholera which occurred in August last in the Sir Jamsetjee Jejeebhoy Hospital in Bombay, in which out of nearly 400 patients being treated in the Hospital for general diseases 84 were attacked with cholera, of whom 66 died. In army and civil population alike then the defence against preventible disease is extremely weak and uncertain. There can be no doubt about the preventible nature of typhoid and cholera, and this being so, it may be asked why are they not prevented. For India the answer to this question is plain and clear. It is that as regards the civil population, which necessarily affects the army in its midst, there is no efficient sanitary service, whose duty it is to prevent preventible disease. Impressed though I have been for a long time with this fact, yet, prior to placing before the Congress my views relating to the need of a more efficient sanitary service for India and the basis on which that service should be established, I felt it incumbent on me to consult a number of the Civil Surgeons distributed over different parts of India and invite their opinions on the subject of municipal sanitation. I confined myself to municipal sanitation, for it seemed to me desirable to follow the lines of least resistance and endeavour to secure efficiency here before attempting seriously any advance in the direction of village sanitation. With that object in view, I addressed to the Civil Surgeons the following questions:—

1. As a Civil Surgeon, have you sanitary duties in the municipality? (*b.*) In what do these duties consist? (*c*) Does the municipality place at your disposal a certain sum of money for this work?
2. Do you think the existing arrangements good or not? and why?
3. What organization for sanitary inspection and sanitary duties, *excluding vaccination*, exists in the municipality? (*b*) Is this organization under the chairman of the municipality or directly under yourself?
4. If there is an organization, what modifications or improvements do you think desirable?
5. Apart from the Sanitary Commissioner and Deputy Sanitary Commissioners of the Province, do you think that a qualified local Sanitary Inspector or Sanitary Officer should be attached for sanitary work to the municipality?
6. Should this Sanitary Officer be under the Chairman of the municipality or under the Civil Surgeon?
7. Do you think that some of the sanitary duties could be combined with those of the present Assistant Surgeon, or should there be an additional qualified man paid by the municipality placed under the Civil Surgeon for that purpose?

Some 70 Civil Surgeons responded to my invitation, many of them supplementing the space I had allotted to each question by private letters entering more fully into the matter. All exhibited a keen interest in the subject, and my first duty on this occasion is to cordially thank those gentlemen for their great courtesy and assistance. A resumé of their opinions has been attached to this paper, and it is remarkable how unanimous these opinions are on the unsatisfactory state of the present arrangements, the powerlessness, as a rule, of the Civil Surgeon in sanitary matters and the necessity for improvement. Equally unanimous are the opinions given regarding the undesirability of the Assistant Surgeon taking over any sanitary duties, *first*, because he appears to be a very hard-worked official, and, *secondly*, because sanitary functions devolving upon him would likely render him unpopular and disturb the confidence and esteem he is now held in by his patients. Instead of employing locally the Assistant Surgeon for superintending sanitary matters, most of my correspondents are in favor of a specially qualified man, some of them suggesting officers in the Subordinate Medical Department, such as Apothecaries, others, Civil Hospital Assistants. Among the suggestions is one that in each province there should be a staff of Assistant Surgeons *trained in hygiene and sanitation especially*, graded and receiving the same pay as Assistant Surgeons in the medical branch, the higher graded men being employed by the larger municipalities; but Assistant Surgeons in the sanitary branch not to be interchangeable with those of the medical branch. These suggestions and others to be found in the summary of opinions in the appendix disclose the sympathetic interest with which the whole question of avoidable sickness and its prevention is considered by the Civil Surgeons.

From the information I have collected it is evident that the power in sanitary matters lies wholly with the municipalities. Government in an undefined way expects the Civil Surgeon to be the adviser on sanitation to the municipalities in his district, but has invested him with no real authority or power to enforce his recommendations, or see that they are carried out, and unless he happens to be chairman of the municipality as at Puri, a circumstance due mainly to special attention having been directed to the insanitary condition of this town, or unless the chairman of the municipality happens to be a European who is ready to listen to the Civil Surgeon's advice the system breaks down. As a member of the Board the Civil Surgeon may by his personal influence be able to get many improvements carried out, especially if they do not involve much expense. As a general rule, however, should a Civil Surgeon in the peculiar position he now occupies, make himself active in sanitary matters, his want of power is soon brought home to him by his advice being disregarded or by a polite note, stating that there are "no funds available." On the other hand, it not unfrequently happens that the Civil Surgeon's time is so occupied with his medical duties that it is quite impossible for him to devote his attention to sanitary matters.

The consequence of the delegation of power in sanitary matters to local authorities without introducing simultaneously an effective system of authoritative guidance and control, has not been sufficiently realised, nor has its paralysing effect been sufficiently appreciated to arouse the Government to action. From a sanitary point of view, it is deplorable that the introduction of local self-government should have placed the sanitary administration of the country in such a position. In every great progressive measure introduced, much that is unexpected and unforeseen is almost certain to subsequently manifest itself and require after adjustment. So it has happened with the scheme of local self-government for the more advanced parts of India. The defect which is the most patent and the most injurious is the total absence of any machinery to carry on *local Government sanitation.* The transfer of power and of duties relating to public health to local authorities totally unacquainted with the principles or practice of preventive medicine and the omission to provide at the same time an efficient and strong local and central agency to guide and control these authorities, are the two important factors at work bringing discredit on local self-government and impeding sanitary progress in this country as a whole.

The kind of agency and the necessity for it will be best shown by a comparison of the sanitary service in England and that in India.

In England with a population of a little over 29 millions and an area of 58,310 square miles, there are over 1,300 medical officers of health for municipalities and sanitary areas, rural and urban. There are also 12 county medical officers of health and more are being gradually appointed. These, with the army of Sanitary Inspectors under them, constitute the local agency of the sanitary service in England. In addition, there is the central agency of the local Government Board with 14 medical officers and medical inspectors, whose time is entirely devoted to enquiries into special outbreaks, inspection work and control of local authorities.

This organization is gigantic when compared with that in India, where the guidance and control of local sanitary authorities might be considered to be more needed than in England.

Bengal, one of the principal and most advanced provinces of India, which is more than 2½ times the area of England and contains nearly 2½ times its population, has a Health Officer for the metropolis, 48 Civil Surgeons, who are *ex-officio* Health Officers and whose unsatisfactory position has already been alluded to, one Sanitary Commissioner and three Deputy Sanitary Commissioners. Were Bengal alone provided with the same strength of sanitary officers per population and per area as in England, then instead of 4 Sanitary and Deputy Sanitary Commissioners, there would be 35, and some 3,200 Health Officers. I am not including in this list the army of Sanitary Inspectors, who in England are necessarily more numerous than the Health Officers; nor Sanitary Engineers, of whom there is now a large number. This contrast will serve to show the defenceless state of Bengal against disease, the absence of the possibility of efficient administration in health matters and the necessity for large and comprehensive changes. Moreover, that which prevails in Bengal prevails more or less and is necessary in Madras, Bombay, the N.-W. P. and Oudh, the Central Provinces, and the more advanced parts of the Punjab, Assam and Burmah. In the less advanced, I am inclined to think that the planter and road-maker are the best sanitary agents. Until the administration of public health is placed on something like a proper basis, it is premature to blame the local authorities in India for their incapability in coping with insanitary conditions. Without a strong local and central agency to guide and assist them the efforts of the local authorities at the best must be misdirected and costly, for sanitation is no exception to the rule which pertains to all specialities, *viz.*, that knowledge is necessary for its practice.

The visits of the Sanitary Commissioner and his criticism and advice in the shape of reports are infrequent and not well understood. The reports necessarily contain a dreadful picture of sins of omission and commission, and show a large amount of work to be done. The effect on the local authority is bewilderment as to how the suggested improvements should be made, succeeded by alarm as to prospective cost. A spasmodic and feeble attempt, of varying duration but never long, is usually made to do something, but the attempt soon breaks down and the old condition of affairs re-appears, while the plea of poverty and want of funds is brought forward as an excellent reason for letting things remain as they were. The usual phrase employed against nearly every proposed sanitary improvement is cost and want of funds. By repetition the expression has almost gained an axiomatic position in Indian sanitation, and is permitted to pass as something indisputable. In populous towns the cost must avowedly be great, for the requirements are large and tax the ingenuity of the most economical sanitary engineers. Still it should not be forgotten that the funds available are also proportionately large. In small towns and villages it is quite exceptional for the necessary improvements to be beyond the resources of the locality, if these are carefully husbanded. It is not with the construction of large engineering works that the sanitation of the major portion of India has to be commenced. Were every municipality to-day made a present of the most costly schemes and placed in the best conditions as to its water-supply, drainage and conservancy, each would be in an unhealthy condition in the course of a year, were there no one with authority and special knowledge in the locality to supervise its public health.

As in other countries three-fourths of the sanitary work to be done in India consists in the checking of epidemics and the strict enforcement locally of good sanitary laws, not so much by costly structural works—though in large cities these also become necessary—but by systematically and constantly removing, checking and preventing those conditions detrimental to health, which individuals, from ignorance, carelessness or greed, insist on establishing. For this purpose a knowledge of the laws of health and of their application to the conditions of city, town, village or district is requisite, which can only be acquired by special training. Progress can be made under no other conditions. The supposition that any body of men, be they ever so highly educated, municipal commissioners or others, in India or elsewhere, possess intuitively a knowledge of the laws of health and of preventive medicine and are able to apply that knowledge in a practical and effective manner, will not stand the slightest examination. It is obviously unsound, and a sanitary administration based on such an assumption would be mere charlatanism. For any effective administration a sanitary service of trained men is required, who shall be interested in the special work ; and the question comes to be, how such a service shall be formed in India on the most economical and efficient plan. I suggest that it should be done by developing and enlarging for purposes of control, enquiry and scientific work, the existing imperial and provincial agency under the Sanitary Commissioner, and also by creating a new agency for local work. This new agency, which should, as a rule, be indigenous in its nature, would open up to the Indian medical talent of the country a new field of activity and occupation. Both agencies would be so connected that, in the event of particular individuals, distinguishing themselves and showing special aptitude in the local service, the reward would be promotion to the central service.

It is unnecessary here to enter into the details of a scheme of this kind. All that is necessary is to indicate the broad outlines which are as follows :—

1. The complete separation of the sanitation of the army and of the military cantonments from that of the civil population.
2. The special sanitary training of students in the medical and veterinary colleges and schools of India ; and the affording to other classes of students facilities for obtaining, when desired, special training in sanitary engineering and architecture in the engineering colleges and technical schools.
3. The compelling of each municipality or combination or group of municipalities or local authorities to appoint a Health Officer after a certain date. Such Officer's appointment, pay, leave, dismissal, etc., being subject to the approval of the Sanitary Commissioner.
4. The formation on every municipal board of a small but special sanitary committee with a medical man, and, when possible, the Civil Surgeon as president and the compulsory setting aside annually of a certain sum of money to be placed at the committee's disposal for sanitary work only.
5. The appointment of the Civil Surgeon on a proper remuneration with defined powers as Chief Consultant Health Officer of the district, and in those places in which he is not available either owing to overwork or other cause, the appointment of a special district Health Officer.
6. The placing of the local and district Health Officers in close relationship with the Sanitary Commissioner of the Province.
7. The placing of the Provincial Sanitary Commissioners in touch with the Imperial Sanitary Office.
8. The representation of health matters on the Imperial Council.

To deal with the army first, I would remove the whole of the sanitary administration of the army from the Sanitary Commissioner with the Government of India, and place it under the army medical authorities. The civil population is quite sufficient for the sanitary Commissioner with the Government of India to deal with. The army should possess its own sanitary organization, and it should certainly possess full control over its permanent military stations, and every cantonment should have a well defined and extensive neutral zone, separating it from the districts under the several local authorities around them. No one not really belonging to that cantonment should be allowed to live within that zone. The strip of land should be grass land and used for parade purposes, and a dairy farm might be placed on part of it, and directly under the control of the cantonment authorities. The present unsatisfactory condition of affairs in regard to cantonments may be seen by the members of the Congress at Dum-Dum, a few miles from Calcutta. There they will see filthy bazaars, filthy bustees and filthy tanks in close proximity to the cantonment and a public road passing through the cantonment itself. In autumn last 64 natives and 2 Europeans were attacked with cholera within a stone's throw of the British Infantry lines. Of the 33 deaths which occurred, the first 15 were around one tank and quite near to the cantonment bazaar. The Cantonment Magistrate lives at Barrackpur, of which place he has also charge. Both Magistrate and the Dum Dum Municipal authorities were written to, but few steps were taken. A young medical officer, Surgn. Captain Winter, who acts as assistant to the Civil Surgeon of the 24-Pergunnahs, did everything he could to allay the epidemic, but he had no special power. The military authorities were practically helpless, until I suggested that Surgeon-Major Harwood should take the matter into his own hands, quite irrespective of law or power, get the police to place a policeman over the infected tank to prevent people from drinking the water, and as soon as possible to empty a cartload of chloride of lime into the tank. Surgeon-Major Harwood succeeded in getting the policeman who appears to have thought so lightly of his duties that he drank the water himself, and died of cholera within 24 hours. This had more effect on the inhabitants than any previous warnings, and deterred them from further drinking of the tank water, and in the meantime chloride of lime and phenyle was thrown into the tank. Other tanks, however, by this time had become polluted with the cholera organism, and it is impossible to know what might have happened, had not a filtered water supply to the troops been just completed, and Surgeon-Major Harwood had the new supply promptly turned on, a standpost being conveniently situated on the very banks of the polluted tank. An interesting sequel to Surgeon-Major Harwood's throwing the cartload of lime and other disinfectant into the tank is a letter from a pleader in Calcutta, threatening him with legal proceedings, unless he pays Rs. 400 to the man who leased the tank for fishing purposes. The fish, of course, died, and had to be promptly removed and buried. This account of Dum-Dum and its cholera will show that reform in sanitary matters in relation to the troops is urgently needed.

To pass on to the sanitary administration of the civil population, the first essential is a trained service, and the only way in which the material is to be obtained from which such a sanitary service can be drawn is by special education at the medical and veterinary schools and colleges. In vernacular and European medical colleges and schools a special course of hygiene should form a compulsory part of the ordinary curriculum. Something of the kind exists in the medical colleges, but it is far from meeting the requirements of the time. Special degrees and diplomas in public health might also be instituted, the examination for which should be open only to those who have undergone, in addition to the ordinary course of hygiene, a six months practical training in public health and laboratory work. Aspirants to the position of Sanitary Engineers, Municipal Engineers, Secretaries to the smaller Municipalities, Superintendents and Sanitary Inspectors, should also possess a knowledge of sanitation, and opportunities ought to be afforded them of studying that part of sanitary science with which they may be called upon to deal, and for this purpose I would advocate that sanitary engineering and architecture should be taught at Seebpore College in India, as well as in the technical schools, a certificate being granted to those pupils who have specially qualified themselves in these and kindred subjects bearing on sanitation. It must be admitted that certain expenses would fall on the Government in the appointment of a professor and assistant professors and the establishment of a properly equipped laboratory at each of the schools and colleges, but the cost might be reduced by the laboratories and staff being utilised for the sanitary examination of food, water and other articles sent by the municipalities in the district, a certain contribution being made by each of the larger ones according to its size and importance. An arrangement of this kind would secure a number of centrally situated laboratories, to which the whole scientific work of the surrounding districts could converge. It would save the larger municipalities the expense of providing a laboratory for themselves. It would insure an ample supply of articles at every medical school for teaching purposes, and it would furnish the Government with laboratories, where any particular kind of research pertaining to medicine could be carried on.

With a body of trained men ready, the next step is to compel every municipality or combination of local authorities, after a specified date, for instance in 1900 or 1902, to appoint a qualified Health Officer, whose duties would be to superintend the registration of vital statistics, the vaccination of those within his jurisdiction, and the sanitation of the locality under him. He would work with the special sanitary committee in each municipality—an arrangement which by separating general municipal matters from those relating to sanitation would secure closer attention.

He would also be in direct communication with the Civil Surgeon or District Health Officer, and through him with the Sanitary Commissioner. The Civil Surgeon of the district, or specially appointed District Health Officer, would in some respects correspond to the county Health Officer in England and the Collector to the county authority.

Under the proposed arrangements there is no necessity for the Sanitary Commissioner of the Province, who should be the Director of the department travelling about from place to place and performing the duties of an Inspector ; nor would the Deputy Sanitary Commissioners occupy their time in general inspection, but devote their attention to enquiries into special outbreaks of diseases and their causes, to investigations into the causes of continued or special unhealthiness of particular localities and to visiting particular municipalities at the request of the District Health Officer made to the Sanitary Commissioner. Attached to the Sanitary Board, which is already formed, should be two or more Sanitary Engineer Inspectors to enquire into and report to the Board the cost, efficiency and character of any scheme of water supply and drainage proposed by a municipality. It is not the function of the Board to draw up schemes for any local authority, but to check proposals that are costly, insanitary and inefficient.

Lastly, in any scheme of a sanitary service devised, no thoughtful sanitarian can lose sight of the fact that in a country like India sanitation is intimately connected with the food question. If 7½ millions people die annually more than that number are born and live. Protection of the population by sanitary measures renders the number of mouths to be filled more numerous. Against this may be placed the fact that with a better state of health, permitting of more steady labour, food production is also increased. But it appears to me that the sanitation which limits itself to the diseases of man is very incomplete. Sanitary science deals not only with the diseases of man but with those of animals and of the vegetable world. A sanitary department should include in its duties the preservation of the cattle of the country from the murrains and plagues, by which they are constantly attacked, and the preservation from pests and blights of the agricultural products of the fields. With that view provision should be made for the investigation of these and the adoption of the best means of preventing them. The civil veterinary department should form a part of the sanitary service. The extra work done in the fields by the animals saved from epizootics with the extra produce and saving to the farmer will develop an additional source of food supply, besides the milk and its products derived from the milch cows preserved from disease. Similarly that portion of the agricultural department concerned with disease of field or other produce should be amalgamated with the sanitary service of the country.

As, however, the investigation of disease, whether that of man, beast or plant, forms rather the scientific department of a sanitary service as distinguished from the administrative, this portion might be merged into one Scientific Institute for India, consisting of experts in the several branches and under the Sanitary Commissioner of India.

SOME POINTS RELATING TO SANITARY POLITY IN INDIA.

BY A. J. HUGHES, M.I.C.E., F.S.S., C.I.E.

THE efficiency of a sanitary administration mainly depends upon three principal factors:—

1st.—The collection and scientific arrangement of accurate vital statistics.

2nd.—Simple local administrative machinery for the initiation, construction, organization and maintenance of the necessary works and measures and for providing ways and means to meet their cost.

3rd.—The efficiency of a controlling central authority charged with the duty of keeping the local authorities active in the discharge of the duties imposed upon them by law.

The science of sanitation may be said to be based entirely on deductions from carefully-prepared vital statistics, made and arranged by members of the medical profession.

In India the progress of sanitary reform depends in no small degree on the clearness and directness by which the state of the public health can be indisputably proved to be dependent on given conditions, which it is within the powers of local authorities to remove. Correctly stated vital statistics may be said to be the lever by which public opinion can be moulded to sanction the measures of taxation and restraint necessary in the common interests: because they appeal most strongly to the principle of self-preservation; they afford the most reliable standard of administrative efficiency; and they constitute the safest guide to municipal progress. The compilation of accurate and carefully-arranged vital statistics is, therefore, the first and most important step in provincial sanitary administration.

The broad facts of vital statistics are in Bengal at present collected through the agency of the village chowkidars by the police department. The births and deaths rudely classified under cholera, small-pox, fever, and other causes are entered in a simple form of register supplied to the village chowkidars, and these registers are produced at a weekly muster appointed for each circle on stated days, and entered at central police station in circle registers. If ordinary care and interest is taken by the District Superintendent of Police and the District Magistrate in working the system, the figures thus collected with regard to the total number of births and deaths are probably sufficiently exact for practical purposes, and at all events we cannot expect to secure any better machinery in collecting vital statistics for some time to come. They are only very approximately reliable as regards the classification of the principal diseases.

In the published returns they are classified by circles having populations, varying from 50,000 to 150,000, and by districts and towns, and in this form the chief lessons which could be derived from the facts available are lost.

Arranged in this way it is only possible to judge generally of the standard of public health in very large sections of the community. What is wanted in the case of towns, for instance, is that the unit of registration should be the smallest practically obtainable. The ward is generally too large a unit, the *mohulla* is generally sufficiently well defined for practical purposes, in order to localize the death-rates and accentuate the causes which produce them. At present, in Bengal, under the excellent management of the present Sanitary Commissioner, we are only beginning our crusade against the demon of disease, and it is evident at the outset that we can only proceed slowly and tentatively against the main factors of defective drainage, sewerage, conservancy, and water-supply, which make up the greater portion of the preventible death-rate.

It is well-known that the average death-rate of a town gives a very imperfect idea of the sanitary requirements, or of the consequences of the neglect of elementary measures of sanitation. When the death-rate is analysed and localised, it becomes evident that not only are there unhealthy and healthy towns, but healthy and persistently unhealthy quarters of the same town, and that certain insanitary conditions are always found to prevail in these unhealthy quarters. It will generally be found that in every town there are certain *mohullas* with death-rates from three to four times the average death-rate due to distinctly removable insanitary conditions. By thoroughly analysing and localising the death-rate in this way, I have generally found it possible to bring home to the local authorities in a convincing way, which no other line of argument would effect, the urgent necessity of simple sanitary regulations. I submit that a great deal more has to be done in this direction to bring home to the Local Government and the Government of India, the terrible instances of annually recurring high death-rates in certain localities, which are to be found in nearly all our towns, and which are within the means of the Municipal Boards responsible for them to effectively deal with.

Turning next to the health of our rural communities and to districts in rice-growing countries, such as Bengal, the existence of the conditions which produce malaria can never be wholly removed; but it is clear that even in a rice-growing country there are healthy districts and unhealthy districts, and that the effect on the death-rate of the ordinary conditions which produce malaria are intensified in some tracts by the want of good drinking water, by the decay of rivers, on the high banks of which the majority of the villages are built, and their conversion into foul cesspools, by shallow tanks filled with the drainage of inhabited sites, and by the want of elementary conservancy arrangements.

To produce that strong public opinion, and that strong conviction which must be the basis of executive and administrative action by the Local Government, new force must be given to the statement of the causes which produce abnormal mortality in every district by better arrangement of well ascertained localized facts.

Until this is done sanitary progress will be slow, and, therefore, I have placed the scientific arrangement of vital statistics foremost on the list of factors of a sanitary polity for India.

The justification of taxation and the inconvenience of sanitary restraints must be made by a convincing statement of the facts to be dealt with.

With regard to the agency by which this arrangement of vital statistics can best be carried out, I consider that the work must devolve upon the Civil Surgeon with establishments supplied by Districts Boards in Bengal.

A subordinate Medical Inspector with the assistance of the District Engineer and his establishments in preparing the necessary maps and topographical details, with a clerk, is probably all the establishment required. With a few local inquiries conducted by the Civil Surgeon and his Medical Inspector and the District Engineer, and his staff, under the instructions of the Civil Surgeon, the local machinery would be complete.

It is, I believe, essentially necessary to make the Civil Surgeon the responsible Health Officer in every district charged with the duty of thoroughly reporting on the public health and the causes which influence it, and representating all questions connected with it to the local authorities and to Government. It necessarily follows that he must be provided with an adequate establishment to enable him to properly discharge those duties. The local Health Officer would be generally controlled in his proceedings by the Central Sanitary Board, which would supply him with forms and instructions and order such special local medical and other inquiries as may be necessary to obtain uniformity of procedure and a full explanation of specially high death-rates whenever they occur. The second principle of efficient sanitary administration I have described to be the establishment of a proper system of local authorities charged with the execution of sanitary measures in the common interests.

The chief local agents of the Central Sanitary authority in Bengal must be the District and Local Boards as now constituted, and for some time to come the work to be done will come under one or other of the following heads :—

(*a*)—Registration of Vital Statistics—

IN MUNICIPALITIES—
- (*a*)—Water works.
- (*b*)—Drainage.
- (*c*)—Sewerage.
- (*d*)—Conservancy.

IN DISTRICTS—
- (*a*)—Protected wells.
- (*b*)—Simple village conservancy arrangements.
- (*c*)—In a few rare cases improving decaying drainages.
- (*d*)—In some cases changing the village site is frequently the cheapest step to take where tanks abound and the conditions are difficult.

In most of these cases engineering advise is requisite, and the District Engineer is the only available agent.

I have no doubt whatever that the District Engineer should be the *ex-officio* chief executive agent of all Municipalities in his district, and that his pay should be divided between the Municipal and District Boards.

On all engineering and executive questions relating to sanitation the District Boards should be advised by the central controlling authority through the inspector of local works. The nature of this advice would mainly depend on the local circumstances of the district and its requirements as set forth in the reports of the local Health Officer.

For some time to come, it appears to be probable that district sanitation will not go much beyond measures for protected well-water supplies carried out partly from district funds under the Local Self-Government Act, and partly by funds voluntarily contributed by the best class of zemindars. Legislation on the model of the North-Western Provinces Rural Sanitation Bill will ultimately be necessary to empower District Boards to deal more fully with village conservancy and larger water supplies.

The District Engineers acting under the professional guidance of the central authority conveyed through the inspectors of local works must be responsible for preparing projects for water supplies and drainages, works and conservancy in all cases, in which his services are required. In most cases these officers are, in my opinion, qualified and able to do this work in addition to their normal very light duties as district road surveyors with some guidance.

The engineering inspectors of the central authority should be sufficiently numerous to make a careful inspection of every town and district at least once a year.

With regard to municipal towns, it may be said that the local machinery is complete for the construction of all necessary sanitary works and measures.

District Boards have already large powers with regard to village sanitation which may require to be enlarged.

The law provides for the formation of local bodies for the construction of drainage works of collective agricultural interest.

Additional legislation is under consideration for the formation of other local bodies for carrying out drainage works when they are required, exclusively for sanitary purposes. It may be said, therefore, that the legislative machinery has been provided for a very complete sanitary policy. In my opinion sufficient motive power has not been provided to put these carefully-devised measures into the proper and vigorous action required by the circumstances of the cases we have every day to deal with, and this at once brings us to the discussion of the third point of administrative efficiency which I wish to place before you, *viz.*, the establishment of adequate control.

The Report of the Royal Sanitary Commission appointed in England in 1869-71 advised that—

> "The administration of sanitary law should be made imperative and universal throughout the kingdom," and that "all powers necessary for the health of towns and country should be in every place possessed by one responsible local authority *kept in action and controlled by a supreme authority.*"

The new department was to keep "all local authorities in the active exercise of their own legally appointed and responsible functions; to make itself acquainted with default and to remedy it; to direct inquiries, medical or otherwise; to give advice and new plans when required; to sanction the larger proceedings of the local authorities; to receive complaints and appeals; to collect medical reports; to issue medical regulations on emergencies." The report goes on to advise that the administration of the laws relating to the public health should be placed under one Minister; that the central authority should be charged with the superintendence of all sanitary authorities and be provided with a sufficient staff of officers; that the central authority should avoid taking to itself the actual work of Local Government and confine itself to guidance and direction only. They recommended an elaborate system of correspondences between the central office and local authorities. Reports of all local health officers were to be transmitted to the central office in forms supplied for the purpose with spaces for statements as to the condition of houses, factories, water-supply, drainage, food, and other recognised sources of ill-health.

I believe that we cannot do better than follow these broad lines in our Indian system of administration. The progress of sanitation in England is largely due to the excellent staff of experienced Medical and Engineering Inspectors acting under the Central Local Government Board in London and paid by the Crown. Sanitary progress in England has also been stimulated by a strong educated public opinion on sanitary question, fostered and promoted by an independent body of medical practitioners and professional engineers second to none in the world in ability and public spirit. The local authorities not only get the best medical advice as to the abstract measures and reforms necessary, but they have at their disposal competent Engineers to interpret this abstract advice into practical, executive action, and deal practically with the questions of cost and taxation into which most sanitary measures ultimately resolve themselves.

In India whatever medical and engineering advice is necessary must be given by officers of Government. There is no independent body of engineers or medical practitioners, and we have to deal with local authorities with little experience on the conduct of large public affairs and imperfectly acquainted with the most elementary principles of sanitation. On the other hand, they have much intelligence and a keen appreciation of what is good for them, and if care is taken to place any sanitary question before them fully and fairly in a practical way, they are probably not more difficult to deal with than similar bodies in Europe.

In my opinion the slow and unsatisfactory progress of sanitation in Bengal is mainly due to the absence of that adequate control from a central sanitary authority with a sufficient staff of properly-trained inspectors, which constitutes the chief feature of sanitary administration in England.

Another retarding circumstance is the absence of properly-arranged vital statistics, by which alone a strong public opinion may be created and brought to bear on sanitary questions.

Lastly, we have to deal with the complete want of properly-trained engineering inspectors to place before the local authorities in a practical way the nature and cost of the measures and works necessary to remove sanitary defects and ways and means for meeting this cost.

In my opinion the reports of the medical inspectors should take the form of an exhaustive analysis of the vital statistics available and a clear statement of the practical lessons to be learned from them. No result can, as a rule, be expected from these reports, unless they are made jointly with a Sanitary Engineer and are accompanied by a definite statement of the practical measures necessary to remedy defects in sufficient detail to enable the local authority to take definite executive action on them.

We have, in fact, launched a number of local authorities utterly inexperienced in administration into the difficult field of sanitation, without sufficient professional guidance and practically without control.

In England the members of the Central Local Government Board are the chief ministers of State. As long as the functions of the Central Board are confined to direction, organization and control, the efficiency of the central authority will mainly depend on the energy and initiation and experience of its professional advisers, and the constitution of the Central Board is not of much importance.

It is, however, in my opinion highly desirable to leave the progress of sanitary improvement entirely in the hands of the persons interested in it and as far as possible free from the direct control of Government.

In Bengal I believe that progress would be faster under a semi-independent Central Board, the members of which should be elected by the Provincial Boards, charged with the control of sanitary and all local administrations and with the duty of providing funds for the maintenance of the necessary controlling establishments by proportional contributions from local authorities. Borrowing powers should be given to the Central Board, and for this purpose they should have power to hypothecate the Municipal and District Board revenues of the provinces.

The securities of Local Boards are not marketable. The securities of a Central Board, such as I have described, would certainly be marketable, and at least as valuable as the securities of the Calcutta Corporation.

On the very small scale on which local works have hitherto been carried out, loans from the Government of India have answered all practical purposes, but it seems likely that in the near future these loans will be restricted by questions of Imperial financial policy. It is in my opinion desirable to make over these works entirely to the people most deeply interested in them, and to remove them from their present state of reliance on the fostering care of an impecunious Local Government.

It is impossible to doubt that this stage must come, and when it does, I believe that the Bengal Sanitary Department and the Department of Local Works is destined to be one of the most important departments of provincial administration.

Sanitation has been described as the cinderella of administrative questions, notwithstanding the old adage that "without health there can be no wealth." The responsibility and the duty of pressing the urgent necessity of greater activity in the promotion of sanitary reform on Government and creating a strong public opinion on the subject rests with you, gentlemen.

By good arrangements I am satisfied that sanitary work may be promoted and made independent of the provincial revenues, and that nothing beyond organization and statesmanship is required to enable the people of India to help themselves to place sanitation on a basis which will enable it to reach the highest stage of legitimate development of which it is capable.

THE POSSIBILITY OF A SPECIAL SANITARY SERVICE FOR THE MUFASAL.

BY A. H. NOTT, M.B.,
Surg.-Captain, I. M. S.

COMMENCING with the cold weather of 1892-93 the control of vaccination of his whole district was handed over to the Civil Surgeon, and it was enjoined on him that a large amount of inspection work in this department was required in conjunction with his periodical visits to his outlying dispensaries. I think most of my colleagues, who are in charge of large and populous districts, will agree with me in considering that what we have seen of the interior of our districts during the last two cold seasons has led us to the conclusion that there is a very important work in many ways to be done in the villages—a work which affects the health and general well-being of vast populations, and also has made us clearly perceive the utter impossibility, under the present arrangements, of doing anything, of any account, to further this work during the rapid visits it is alone possible to pay to the Mufasal portions of our district.

In very few of the districts in this province does the urban population, living in Municipalities, amount to over 5 per cent. of the total population, and in many it is much less than this. It cannot therefore be denied that the State owes something to this vast majority of its subjects living in the multitudinous villages in the rural areas of these districts. It appears to me that these duties, so far as they affect the medical services, may be grouped under three heads.

Firstly.—The duty of affording them much more extended opportunities of obtaining medical aid of a modern character, the present number of charitable dispensaries being much too small to more than touch the fringe of the suffering from disease which even yet, especially in the more backward districts, mostly goes absolutely untended.

Secondly.—The provision of an efficient and well-controlled system of vaccination, so well controlled by superior officers, that the many abuses which now exist may be almost done away with, so efficient in fact that there will be no possibility of the evils arising which are at present foreseen, should compulsory vaccination be introduced, without improvement of the present staff.

Thirdly.—Purely sanitary work which, up till now, has hardly been attempted outside Municipalities. Although they differ regarding the organization which would be necessary to carry it out, all authorities seem to agree that the time has arrived when some attempt should be made to improve the cleanliness, or rather the want of cleanliness, of the average village, and to do something to insure an wholesome water supply. A much more effective system of scientifically determining the causation, spread and characteristics of epidemic disease in the country districts is also an urgent necessity, if this country is to hold up its head at all with European nations, and if the medical profession in India is to wipe away the reproach that we are indebted to Continental authorities for all our advances of knowledge in tropical diseases.

The above appear to be the needs of the Mufasal, even in the most backward parts of this province, but in richer and more advanced districts there is much to be done in connection with sanitation of a much more extensive character; and, although, possibly, the remedy of these more widespread sanitary defects lies more in the province of the Sanitary Engineer, yet any extensive works carried out with this end would be, to a great extent, wasted, unless accurate observation on the health of the population affected by them was recorded by a trained specialist, who must of necessity spend much of his time at intervals in the neighbourhood. In no other way will it be possible to correct errors and form satisfactory judgments of the advisability of introducing similar sanitary improvements in similarly affected localities.

If it be allowed then that the time is now approaching when a really effectual effort should be made to afford these services to the rural population, the question, which is an extremely difficult one, to answer in the present financial condition of the country, arises as to how this is to be done and what agency it should be performed by. There are districts in this province, and probably many in other provinces, in which from their small area and density of population, combined with easy means of communication, it seems possible that the Civil Surgeon of the district could, without really neglecting his duties at head-quarters, do most of the work required ; but I think most of the Civil Surgeons in this province will agree that an attempt to do this generally would end in all their work being inadequately performed. It is evident the Government look upon the duties of the Civil Surgeon as a medico-legal expert and as a jail sanitarian as being above all his most important work, and an absence for five or six months in the Mufasal during the year must largely interfere with both of these duties, even if it be allowed that the work at the charitable dispensary should be left, during the period of the year most favourable for surgical work, entirely in the hands of the medical subordinate. Further arguments for the necessity of some special organization do not appear to be required, unless a radical change in the ideas of the relative importance of the work of the Civil Surgeon at head-quarters is entertained, and, though for my part I can see many arguments in favour of such a radical change, yet I think it is practically certain to be considered out of the question.

Several plans have been proposed, or naturally occur, when considering the subject as solutions of the difficulty of providing a special sanitary officer for each district, a security for any really effectual sanitary agency, but there appears to be little hope that either the plan of appointing a commissioned medical officer to each district, in addition to the Civil Surgeon, or the plan of the formation of a service entirely confined to Assistant Surgeons, will ever be found workable, the former plan on account of its enormous expense and the latter for several reasons, particularly its almost certain failure to draw the best men from that class.

A plan has occurred to me by which it appears that a fairly satisfactory and workable sanitary service for the Mufasal may be organized without any very great expenditure to the empire as a whole in excess of the present, and especially commendable as not increasing the future pension lists, and yet will provide the luxury of an European staff. It may appear to be a very original and sketchy idea, but in the absence of any more practical scheme I feel it is at least worthy of consideration. The principle, however, on which it is founded I feel certain would be strongly opposed both by many members of the service and military administration should it ever be entertained by the civil authorities. The plan I would propose bases itself on the belief that it is better in times of peace to endeavour to alleviate the widespread ills that affect 150,000,000 people than to give a highly paid European medical attendance to 100,000 or less native soldiers whose ailments are, as a rule, of comparatively trivial import. So far as I have seen native soldiers receive a more close daily attention from the commissioned medical officer than any other class of native sick do, not even excepting the carefully tended prisoner.

The plan then that I would suggest is, that in times of peace the treatment of the native army should, to a very considerably greater extent than at present, be placed in the hands of subordinate medical officers ; with a general supervision I consider a large proportion of the military hospital assistants are quite fit to undertake this. I would propose that one-half of the present number of commissioned medical officers in military employ should be set free from their present duties, leaving at least sufficient to have one medical officer always present in each station where there are native troops alone, who should have charge of all the officers and their families, and should visit frequently all the native hospitals, and personally perform the more important duties which are liable to be abused by subordinates, such as examining recruits and passing men for sick leave, etc. These duties, as I have had ample opportunity of judging, would not be too severe even in a station with three regiments. If this were done, even allowing for the usual percentage for sick and ordinary furlough, between fifty and sixty officers would be set at liberty.

The chief objection no doubt that would be raised is that this proceeding would dislocate the arrangements of the medical services for war, but in reply I would say that it would be very easy to arrange that in each province all the officers thus told off to the sanitary service might once a year, during the hot weather or rainy season, preferably the former, be deputed to a convenient military station, where they should go through a course, lasting two or three weeks, of ambulance drill and instruction in the work of a field hospital, which might be kept there ready for immediate service ; and that from each province for comparatively small wars, such as we have every two or three years on the frontiers, this field hospital should be despatched to the front with medical officers taken from the sanitary service of the province who had been thus accustomed to work together. This would be at least as speedy and as satisfactory as the present system, and, as only four commissioned officers are required for each field hospital, the sanitary service would not be dislocated entirely even for a war of very considerable importance. In the event of war occurring of a very serious character, it would not be too serious a blow, when the system had been well started, to hand over the whole of the duties to the Civil Surgeon of the district for that officer to carry them on as best he might ; this calamity need not, I think, be taken into account. One other objection would be that there would be a difficulty in supplying a commissioned medical officer to each regiment on occasions of active service of comparatively small moment and for route marching, etc., but in the somewhat considerable duty of this kind I have seen, I have felt that no serious harm would have resulted if the number of medical officers with individual regiments had been less. As a rule, their duties are almost nominal, though no doubt this would not apply in expeditions in unhealthy districts, such as Burmah and the Lushai Hills, where certainly an officer with each regiment would be a necessity.

Having arranged for the services of a certain number of commissioned medical officers without having made any serious addition to the financial burden of the empire as a whole, let us consider how they might be utilized in this province? Considering its population and wealth and its general unhealthiness and sanitary needs the share of Lower Bengal of these officers should not be less than twenty-five. In addition to this number, with the present three Deputy Sanitary Commissioners, who would not be required, at least to perform the duties they at present do, it would require only twelve or thirteen officers to complete a service which would give one sanitary officer to every district. At present the province is divided for sanitary purposes and registration of vital statistics into fifty districts, but this includes certain tributary and political states, Calcutta itself, and several other districts, in which, either from their small size or from the fact that there is or will be another superior medical officer at head-quarters, it would be quite possible for the Civil Surgeon to satisfactorily perform these sanitary duties, so that a service of about forty officers would be sufficient. These thirteen additional officers should be, I think, Assistant Surgeons, specially selected for their sanitary knowledge and well paid; and should be, so far as their duties go, on an equality and interchangeable with the commissioned ranks.

It would be fair, I consider, that the pay and travelling allowance should not be charged to district funds, so far as regards these superior officers, but these funds should supply camp equipage, inferior establishments, which should include a hospital assistant, and a portable supply of medicines, with a small surgical outfit.

In conclusion I will simply outline the duties which should be required to be performed by this special service, and by Civil Surgeons of those districts in which no special officer was considered necessary.

Firstly.—The control of vaccination, including the direct superintendence of an animal vaccine station in each district.

Secondly.—The organization and close inspection of a system of village sanitation. At first these officers might make a definite sanitary survey of the needs of the whole of the district, thana by thana, so that an annual return, as at present required by the Army Sanitary Commission, may be brought into existence based on really accurate information. The special sanitary organization that appears to be the most possible is the grouping together of two or three villages into a unit of local government with the appointment of one or two of the leading inhabitants of each village together to form a village council, and to place the actual carrying out of ordinary sanitary work in their hands, but under the orders of the district authorities and advice amounting to commands of the sanitary officers. This council should be compelled in every instance to provide a supply of reasonably good drinking water and to keep it free from pollution, to ensure the general cleanliness of the village, and to introduce some simple and easily-worked system of disposal of night soil in an unobjectionable fashion, and to do something to improve the through ventilation of enclosed villages.

Thirdly.—Enquiry into the origin of and organization of means of suppressing epidemics of cholera and smallpox, as well as of outbreaks of unusual severity of endemic diseases, particularly dysentery and malarial fevers, and enquiries also into the undue prevalence of these latter diseases in particular areas. In the leisure time at the disposal of this establishment, during recess season systematic bacteriological and other laboratory investigations should be conducted by these officers at the head-quarter station of the district in conjunction with the Civil Surgeon.

Lastly.—In order that the ignorant general populace should be able to see some tangible result of the visits of this officer, I would, at the expense of the District Board, provide him with the aid of a Civil Hospital Assistant, and give him a supply of medicines, etc., so that he should not go empty-handed into far away villages, and be unable to relieve such cases of distress as would crowd round him at every camping ground. Much might be said concerning the great good this would do in furthering confidence in European medical treatment and of its value as a feeder to the already established charitable dispensaries; besides its value as affording a valuable experience to the medical officers himself who would thus see the lower native classes, as they are in their own homes, much more closely than these officers do at present. The effect of this in showing the rural population that Government had some care for their welfare, otherwise than through the police system, would be no doubt of great value in aiding the continuance of a contented spirit among the cultivators of the soil which seems to show signs in some districts of passing away.

In order to prevent this service being officered by a constant succession of very junior officers, it seems easy to order and carry out a rule that no appointment should be made either permanently or temporarily, to the regular Civil Department until four or five years had been spent as a sanitary officer. This length of time would be sufficient for the officer to learn the language and ways of the district, and give several years of really valuable service in his most energetic days.

DISCUSSION.

R. Harvey (Calcutta) thanked Dr. Simpson for his most able address, with the whole of which he agreed. Without consultation with him he had sketched out a similar scheme. He was sure that, without a special class of Health Officer, no great progress was possible. The duties of the Civil Surgeon are so important, so multifarious, so constantly increasing, that he could do no real work as a Sanitary Inspector. Inspection was absolutely necessary, and the Civil Surgeon has no time for systematic inspection. He thought that the proposed Health Officer should be of the Assistant Surgeon class, graduates or licentiates of a University, and that, if Municipalities and Local Boards were made to contribute *pro rata*, there should be no difficulty as to their pay. In the Punjab, Municipalities are already required to spend 18½ per cent. of their income on sanitary work. If this provision were extended to Bengal, good sanitary progress would be possible. Many rich Municipalities are spending as little as 2 per cent. of their incomes for such purposes. The only point as to which he was doubtful was the proposal to divorce the sanitation of cantonments from general sanitation. He thought all sanitary questions should be under one head. This, however, is a mere detail.

Hendley (Jeypore) said that he had heard the views of Dr. Simpson with great interest, the more so as they coincided, to a very large extent, with his own ; an effort was now being made to carry out similar ideas in the large Native State of Jeypore ; he had been for some time past in co-operation with a committee in studying the question of village sanitation, and had just received the news that His Highness the Maharaja had sanctioned the scheme drawn up. It was briefly as follows :—

1. The sanitary service to be a branch of the Medical Department, and under the general supervision of its head.
2. There shall be two sanitary inspectors, one of whom shall be an Assistant Surgeon, with special training on the pay of his grade, with liberal allowances to compensate him for the loss of private practice, and attach him to the service ; the other at present to be an experienced and educated Engineer, as junior inspector. Both men to be active and able to ride, and they must devote six months in each year in the villages and at work in the towns or in any special inquiries when required by the medical officer. Vaccination was also a part of their duties.
3. Provision was made for a small clerical staff.
4. The total cost at present for the State is Rs. 5,000.
5. The duties of the inspectors will be to visit all villages, to advise as to the best means of providing a pure water supply, for storing manure, for dealing with the latrine question, and keeping the village clean and of raising them. In case of want of funds, Government will take steps to help the people in the construction of wells, &c.

At present Dr. Hendley said they did not propose to ask for special funds. Rao Bahadur Kantee Chunder Mukerjee, their chief member of council, thought such a demand might wreck the project at the beginning before the people whom they wish to carry with them are alive to the advantages of sanitation.

Their scheme for the capital was more elaborate, but that the inhabitants were more intelligent and educated. They were making an effort to introduce sanitary primers in all schools, and to arrange for lectures to minor officials on sanitary subjects, all to be under the control of the Civil Surgeon or Medical Superintendent of the State. At present the Civil Surgeon has so many masters that it was impossible for him to present a united front against the enemies of sanitation. He was glad to see that Dr. Simpson's proposal agreed with his, and he hoped to see the principle extended still further, and that, as in former times, the administrative medical officer will be the real head on all medical and sanitary matters. The more sanitary experts we have the better, but they should be graded and promoted among themselves, and not look to advancement as Administrative medical officers. He said that he had, in Jeypore, all the powers desired by Dr. Simpson : he controlled the vaccination, which is inspected by his assistants ; he inspected the dispensaries, he was health officer of a town of 160,000 inhabitants ; and although he saw all cases of grave import in the jail and supervised their matters, his time was not taken up in the petty details of looking after manufactures, so that he had full facilities for his more important medical duties.

W. H. Gregg (Calcutta) said there was one point on which he wished to lay special stress, confining his remarks to Bengal, and that was that whatever sanitary reorganisation was introduced, the district should remain the unit of administration, and that the Civil Surgeon of it should remain the responsible executive officer for all medical, sanitary and vaccination matters, and work in consultation with the District Magistrate. Till the beginning of 1892 the Vaccination Department was practically independent of the local authorities and received little help from them. In that year the Vaccination Department was reorganised, and since then considerable improvement has taken place in it. In any scheme of sanitary reform in Bengal, it should always be remembered that there are forty-seven districts of great area and containing an average population of over one million and a half, three times greater than the average population of the Punjab Districts.

A. Banks (Puri) said that Dr. Simpson had referred to Puri, which he represented in a double capacity, as Civil Medical Officer and as Chairman of the Municipality. As Chairman he was in a position to see his own orders carried out. Dr. Simpson mentioned the objections to the Assistant Surgeon carrying out sanitary reforms. He believed also that the combination of these two offices did not increase the popularity of the Civil Surgeon also. He mentioned that in Puri Municipality 75 per cent. of the income was spent on sanitation, and many things could not be done for want of more funds.

D. Basu (Beerbhoom) said that, as Civil Surgeon, he had often felt the need of a sanitary organisation. The district inspector of vaccination is asked to inspect the source of water supply, but is absolutely ignorant of such matters. He considered there should be a class of special sanitary inspectors to assist the Civil Surgeon, specially trained in the subject, and that the Civil Surgeon should be authorised to pass orders on urgent cases of sanitary defects. He agreed with the suggestion that village committees should be forced to spend a specified sum of money on water, general cleanliness, and ordinary surface drainage. He was convinced that if such steps were taken gradually, without any heavy taxation, there would be no objection of any strength or importance. He considered that the teaching of hygiene should be insisted upon in all schools and colleges.

The President of the Section said that whilst the interchange of opinion on these subjects was valuable, there cannot be the slightest use in the accumulation of theory, unless it be possible to apply it in practice. All the speakers were agreed as to the practical difficulties, and also that our present systems cried for remedy. He said that in his important opening address, His Excellency the Viceroy, while not forgetting the claims which medical science has upon the Government, laid down, in terms unmistakeable, the standard rule upon which, not only sanitary, but all other matters are administered, namely, a strict regard for the religions of those governed, and he encouraged us to hope that the Government of India would welcome suggestions that, whilst not touching upon this *magna charta* of the people, would enable it to cope with the enormous loss of life from causes which are obviously imminent. In his excellent opening address, the President, Surgeon-Colonel Harvey, endeavoured to cheer onward the sanitarian in his up-hill work. In his own address in this section he surveyed the position in which their efforts up to date had placed them, and pointed out that their great ally—education—had outstripped them. With themselves lay the blame of not having utilised the advantages which the association of the Sanitary Department with the Government since 1864 had given them. Mr. E. Hart had shown that the world at large was looking to India to take its place in the rank of sanitary countries. It seemed to him that it was this feeling that India lags behind the rest of the world that led to this Congress. It was not difficult, he went on to say, to find a solution of this matter. Sanitation cannot advance from theory to application without *correct organisation*, that is a Public Health Department with powers and a special staff fitted to the task. They have had before them papers that denote that the subject has arrested general attention. Those by Dr. Nott and Mr. Hughes have great value, as expressions of opinions of men who have studied the subject, and are thus helpful. That by Dr. Simpson is the outcome of the experience of a specialist who has studied the subject in Europe and India, and is supplemented by an appeal to sanitary officers throughout this country. The evidence before them went to show that the present organisation was insufficient and did not meet the requirements. He would refer them to a particular passage in Dr. Simpson's paper as an expression of the various reasons for this discontent. There Dr.

Simpson showed that a knowledge of the loss of health could only be acquired by special training ; that the supposition that any body of men, ever so highly educated, possessed intuitively this knowledge was devoid of the slightest foundation. He believed that Madras, in respect to sanitary organisation, was in advance of the other Presidencies. In it, under the advice of Surgeon-General Cornish, in 1881, at each district head-quarters, a highly educated assistant surgeon was placed capable of taking charge of the station and jails during the Civil Surgeon's absence. The Civil Surgeons were henceforth known as district medical and sanitary officers, and were expected to inspect their districts systematically and advise public bodies. Under this system the Sanitary Commissioner was able to keep himself informed as to sanitary progress throughout the country. However, since this method was inaugurated, the duties of the medical officers had increased to an enormous extent by the multiplication of hospitals and dispensaries throughout their districts. What Surgeon-Colonel Harvey had said about the typical Civil Surgeon of Bengal was true also of the medical and sanitary district officers of Madras. The tasks they have been called upon to fulfil were rapidly becoming impossible, each district medical officer had more administrative work thrown upon his hand than was ever dreamt of in the office of the old class of Deputy Surgeon-Generals. The movement, therefore, though in the right direction, had failed for the reason given by Dr. Simpson, *viz.*, that for sanitary work a special class of officers were needed whose whole time could be devoted solely to that work. Another cause for failure was the delegating the sole power of action to public bodies who were insufficiently acquainted with sanitary dictates. He would illustrate by an example the weakness of the present system. One of the largest Municipal towns in Madras was attacked with cholera last year. The local sanitation was bad, but it was hoped that, by strict isolation and destruction of the cholera excreta, the spread might be checked. Advice was repeatedly offered to the Municipal authorities, but it was not till towards the end of an epidemic, lasting four months and causing the loss of 1,500 lives, that any steps at even elementary preventive measures were taken, the excuse being "want of funds." He was glad to say that the Madras Government on his representation have passed orders to prevent such a recurrence in the Municipality concerned, and have under consideration a scheme for concerted action in all Municipalities in such a state of affairs. Under a properly arranged Health Department, such occurrence would be impossible. Again, it is impossible not to perceive that, under the local bodies which the Local Self-Government scheme has brought into existence, much money is wasted for want of proper control. These bodies first think of erecting lamps to light the streets before the simple matter of the disposal of night-soil is thought of. The time did not permit him to show other examples of gross waste, experiences which forced on him the desirability of advising the Government to control expenditure by Local Sanitary Boards, subject to a central authority. This prosposal has, however, been twice rejected. He attempted to get the district sanitary officer appointed an *ex-officio* Vice-President of the District Board, so as to be in a position to control expenditure. A proposal of a similar nature has recently been submitted by one of their Collectors, coupled with the further suggestion to give the district medical and sanitary officer certain powers over the village headmen. He was glad to say the Madras Government had accepted his suggestions for the training of the sanitary inspectors, and early in the new year the first class for this purpose will meet in Madras. He considered that the lesson of these difficulties was to show the pressing necessity for a special staff of trained men having power of control over sanitary expenditure, governed by a central authority and aided by scientific institutes in various parts of India.

He went on to consider "the two scarecrows : " firstly, "prejudices," secondly "no funds." As to the latter they had every right to dismiss it, the funds already at the disposal of sanitation were, he had shown, often ill-spent, and funds which should be available for sanitation were spent upon useless refinements of education. As to the greater scarecrow, "prejudice, " he claimed that the only way Government can understand what they were, was by the organisation of a Health Department such as depicted above ; that only by the medium of a staff versed in sanitary matters brought into daily contact with the people could a true estimate of these prejudices be formed.

In short the basis for sanitary working in India must be looked for in the repetition from one end of the country to the other of such practical observations of the people as His Excellency the Viceroy informed them, at the opening of the Congress, he himself has made in a remote village. He there saw side by side sanitary neglect, malarial fevers, and a high death-rate. His Excellency here made a deduction from practical observation, that was, he followed the methods that would be pursued by the specially-educated sanitary staff here pleaded for. Were this question of "prejudice" alone considered, it showed the necessity of a sanitary staff sufficiently numerous to keep in touch with the people. He would be a rash man who would say that the same prejudices existed in two villages, say, a hundred miles apart. This term had only been invented to hide their ignorance of the people, its feelings, and its customs. It is absurd to suppose that a specially-educated class of sanitary officers would not have tact enough to carry out or modify sanitary appliances without riding rough shod over prejudices. There would then, he said, remain no doubt in the minds of their rulers that the instincts of the people were towards cleanliness, but that hitherto they had not had any opportunities of exhibiting those tendencies. Prejudices, he considered, had usually no basis upon religious belief, but merely represented the aimless reluctance to accept new conditions, of which the people can form no estimate from an appeal to memory or former experience. In short, though he would be the last to forget that perverted religious ideas could not be ignored, yet he was of opinion that in India they have to deal with a reasonable people, who, although they cannot comprehend abstract sanitary theories, he had never known them to fail to appreciate the benefits thereof. Therefore he concluded their rôle is *not to wait* till the craving of the masses for sanitation occurs, but to take it to their doors by means of a staff acquainted with their habits and opinions, and show them the benefits of hygiene, trusting to their cleanly instincts to secure a grateful and happy people.

ON THE VALUE OF THE CHEMICAL AND BACTERIOLOGICAL EXAMINATION OF WATER.

BY A. M. DAVIES,
Surgeon-Major, Army Medical Staff.

I. Water examination: its objects and limitations.
II. Indications afforded by chemical examination.
III. Indications afforded by bacteriological examination.
(*a*) Detection of *Bacillus typho-abdominalis.*
(*b*) Detection of *Spirillum choleræ asiaticæ.*
IV. Practical suggestions for rapid examination of water, chemical and bacteriological.

I.—*Water Examination : its Objects and Limitations.*—The object of water analysis or examination is to enable the examiner to give a trustworthy opinion as to its wholesomenesss or the reverse. A complete analysis is neither possible in the majority of cases nor is it required. It is necessary to be acquainted, first, with the composition of the different kinds of potable water which exist naturally and in an unpolluted condition ; secondly, with the various impurities that are likely to be found in water, derived from various sources, of which those from human habitations are the most important.

As regards the first point, chemically pure water is unknown in nature. The different natural waters used for drinking are: Rain water, spring water, river water and lake water. Water derived from a deep well resembles spring water in its characters: that from a shallow well cannot, as a rule, be looked on as a natural water, being almost always liable to contamination. Now none of these waters consist only of two parts by weight of hydrogen and sixteen parts by weight of oxygen; but the substances that may naturally be present in them, if denominated impurities, are of absolutely different significance and exercise very different effects from those that are added to water in a non-natural manner. It is necessary therefore for the analyst to know what the *natural* composition of any sample of water may be expected to be before he can safely certify to the presence, or absence, of *added impurity*.

Secondly, a knowledge of these added impurities that may find their way into water is required. They are conveniently considered under the two heads of—(1) impurities due to source, and (2) those due to storage and distribution. With regard to the first class, for instance, rain water is naturally the purest of all in a chemical sense; but if the portions of the atmosphere through which it has passed are dirty, the rain itself will be impure. Spring water, or that derived from a deep well, is the purest in a biological sense; there may be few micro-organisms, or almost none at all, the water having been subjected to a process of natural filtration; but there are circumstances, such as the occurrence of a fissure in the chalk formation (which is by no means uncommon), which will bring about most dangerous pollution of a naturally first class water. As to the second class of added impurities, those that take place during storage may be derived from the place where the water has been kept (as a metallic cistern), or from imperfections in the mode of storing it (as access of dust, &c., in a house cistern, or of filth of all kinds in a tank or unprotected reservoir). The impurities added in distribution may again be divided into two categories—(*a*) those gaining access to open channels, which may be surface washings from cultivated land, refuse from industrial processes, or sewage impurities; or (*b*) impurities derived from the pipes that convey the water, such as lead in solution.

There are certain diseases that are known to be caused, to a greater or less extent, by impure water; if the actual necessary causes of such diseases were in every case known, the analysis of water would consist in testing for their presence. To take the simplest case: lead poisoning amongst a population using one particular water supply might be definitely attributed to the drinking water, if this were found to contain lead in solution, in any quantity greater than, say, $\frac{1}{5}$ or $\frac{1}{4}$ grain per gallon. The actual causes of infectious diseases are, there is at present every reason to believe, particulate; if these particles were known and capable of recognition by definite tests, microscopic or otherwise, their recognition in water would, *ipso facto*, prove it to be unfit for drinking; at the same time, failure to recognise them would not prove that they were absent, nor that the water was wholesome. Our knowledge of the causation of disease has not however yet attained to this point in regard to all, though it has in regard to some diseases. All diseases are not caused by bacteria, neither are all pathogenic bacteria (in practice) easily recognisable in water. Therefore water analysis must be directed to the obtaining of collateral evidence or indications as to the likelihood of their presence, or the contrary. Moreover, though a water may be quite free from the (hitherto recognised) specific pathogenic bacteria, it may have been contaminated with substances prejudicial to the general health when imbibed with drinking water, yet not (so far as is known) capable of producing any specific disease.

Now the presence of *organic matter* is held with very good reason to indicate that the water has been contaminated; though some waters containing large amounts of organic matter may be fit to drink, provided that this organic matter is of a certain kind, *e.g.*, vegetable matter from peat. If the organic matter can be shown to be *animal origin*, the contamination is of much greater importance than if it were only from vegetable sources. Lastly, if this animal organic contamination can be shown to be derived *from human habitations*, a water containing such impurity should undoubtedly be condemned as unfit for drinking. For ordinary water analysis this is the most important point to decide with regard to any one given sample, its freedom from, or pollution with, animal matter from human habitations, in other words, *sewage impurity*.

Water analysis has passed through several stages. At first it was thought that if a water was clear and sparkling, of agreeable taste, and without smell, therefore it was fit to drink. But it came to be found that such a water, on being tested by chemical methods, might show signs of serious pollution, and, as a matter of fact, might spread disease. The notorious Broad Street pump water, which was the cause of a localised outbreak of cholera in the London Epidemic of 1854, was of such a particularly agreeable character that an old lady, a former resident in Broad Street, who had retired to the seclusion of Hampstead, continued to drink this water, which she had sent up to her every day by carrier. She took cholera and died. Everyone who has had to do with water examination knows that people are often not only satisfied, but delighted, with the water they drink, although it may be undoubtedly polluted in the filthiest manner. It came to be found, then, that chemical examination was necessary to testify to the presence of organic matter and other substances occurring in connexion with it: this was the second stage. The third stage resulted from the development of the germ theory of disease. When it was admitted that the germs of enteric fever or cholera in water might spread these diseases, and when it was found that such germs might be present, and yet be quite incapable of detection by the microscope—also that in other respects such dangerous water might show no indication of its danger or unwholesomeness by any chemical tests yet known—it was seen that bacteriological examination must form a most indispensable part of water analysis. An instance in point is related by M. Gabriel Roux : A certain restaurant at Lyons was renowned for the fresh and palatable character of its well water, so much so that many people repaired to this establishment for their repast on this account. It happened that a great many of the waiters who ate and slept at the restaurant fell ill of typhoid fever one after the other. The water was analysed chemically, it was found to be excellent.* Bacteriologically, it was found to contain enormous numbers of *Bacillus coli communis*, testifying to its contamination from a neighbouring privy. The well was closed and no more typhoid occurred.

At the present time a combination of chemical and biological or bacteriological methods is requisite. The indications afforded by the latter alone are not at present sufficiently precise, nor their study sufficiently advanced to render chemical analysis unnecessary. It must, however, be borne in mind that the real aim and object of the analysis is to detect the presence, or certify the absence, of, first, the specific disease-poisons ; secondly, any substances known to be hurtful. When direct evidence is not obtainable, indirect indications must be made to yield their testimony.

To take an example. Enteric fever is spread in many, probably most instances, by the contamination of water with the stools of an enteric fever patient. If the supposed specific cause, *Bacillus typhi abdominalis*, be detected, the sample is condemned without hesitation. But if *any* fæcal matters are found in water, it is condemned, because, even if it does not cause enteric fever, it is unwholesome as well as disgusting. Fæcal matters, however, even if present, may not be capable of detection, therefore some other indication must, if possible, be taken. Now fæces gain rarely access to water without being accompanied by urine. Urine always contains, or by its decomposition gives rise to, large amounts of saline ammonia and chlorine ; therefore, if a water is found to contain much free ammonia and chlorine (without satisfactory explanation of their presence being afforded), it is a presumption that they are derived from urine, and therefore that excremental pollution has occurred. If this has happened once, it may happen again ; and if specific enteric stools chance to be present at any time, obviously here is a mode in which the disease may be spread ; the water must be looked upon as *dangerous* and *unfit for drinking*.

II.—Indications afforded by Chemical Examination.—In the earlier days of chemical water analysis, after exact processes had been devised for the detection of certain substances in solution, definite standards of purity were laid down for the average constitution of a wholesome water ; and if a sample were found to contain amounts of (say) chlorine, ammonia, nitric acid, and so on, in excess of these standards, the water was looked upon as more or less suspicious or impure. Of late, and since the application of bacteriological methods, some discredit has been thrown on this principle of applying, as it were, hard and fast rules ; though there is still a widespread idea that an analyst has only to perform some chemical experiments, and forthwith to be able to pass a verdict on the wholesomeness or the reverse of a water sample. Dr. Thresh, County Medical Officer of Health for Essex (an analyst of much experience) writes (B. M. J., 1894, ii, 362) :—

"The presence of organic matter may be chemically demonstrated ; but, inasmuch as its nature, whether poisonous or innocuous, is beyond the power of the analyst to reveal, it is obvious that a mere chemical analysis may be worthless, or even misleading. This point cannot be too strongly emphasised, since the popular impression that the chemist, by performing a few mysterious experiments with a water in his laboratory, can pronounce at once whether it is pure or impure, safe or dangerous, is shared alike by the ignorant and the learned, and must be dispelled." While fully allowing this to be the case to a certain extent, I do not see how one can do away with the use of certain standards, though they must undoubtedly be applied with judgment and discretion, and not like a foot rule.

Confining ourselves to the estimation of the organic matter only, we have (1) the permanganate of potassium method, according to one or other modification, for determining the amount of oxygen required to oxidise the oxidisable matter present ; (2) the albuminoid ammonia process, indicating the amount of nitrogenous matter in combination as albumin or other proteid ; then (3) we can estimate the amount of ammonia existing free, or in loose combination as ammonium carbonate, or some analogous saline body ; (4) nitrous acid as a nitrite ; and (5) nitric acid as a nitrate ; (6) chlorine may also be derived from organic matter ; and (7) sulphuretted hydrogen and alkaline sulphides.

The object to be attained is, first, the detection and estimation of organic matter ; secondly, to find out if it is of animal origin ; thirdly, if it is derived from human habitations. It cannot be denied that water containing this kind of impurity is unfit for drinking. Now there is no difficulty in detecting the presence of organic matter ; both the potassium permanganate process and the albuminoid ammonia process are available.

Neither of these processes is to be taken as giving *absolutely* exact results, but *relatively* they certainly afford a means of comparison between different kinds of water, which is most valuable. The organic matter, or nitrogenous matter, thus estimated may be however either vegetable or animal, or both ; and these processes do not help us to determine of what kind it is. Indeed there is no chemical test which can, as yet, distinguish between the disintegrated and dissolved proteids, whether they are of vegetable or of animal origin ; and of their actual chemical constitution we are ignorant. There are two substances, however, whose presence in water can be estimated with very considerable accuracy, and which may give very decided indications of the presence of that form of animal organic contamination most to be dreaded, *viz.*, excrementitious matter; these are chlorine and saline ammonia. It is to these four substances, I venture to assert, that the analyst should chiefly direct his attention; and the indications afforded by their detection (and still more, quantitative estimation) cannot, I also venture to assert, be disregarded.

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* The nature of this chemical examination is unfortunately not stated.

With the above qualifications, I submit that the determination of these constituents of water by chemical analysis is most useful, and indeed necessary, for obtaining a correct opinion as to the wholesomeness of a drinking water. Excess of chlorine, of free ammonia, of albuminoid ammonia, of organic matter as shown by the oxygen required for its oxidation, may all individually be satisfactorily explained; but they are all so many symptoms which, if they occur together, furnish a diagnosis of a water dangerously contaminated. It is not safe to pass a water as wholesome because of the small amount of any one possible or probable index of pollution. Neither is it allowable to condemn a water as unwholesome on account of the excess of any one. The whole analysis must be passed in review, and due weight attached to all the various "symptoms." Of all these symptoms, I believe the conjunction of excess of chlorine with excess of saline ammonia (indicating contamination with urine, therefore also with fæces) to be the most significant; but this may quite possibly occur in a good and wholesome water from a deep well.

As to what constitutes *excess*, while the figures previously given may be taken as representing expert opinion as to the limits which should not be exceeded as a rule, by the various substances of which notice has been taken, it should be clearly understood that much discretion must be allowed in their application. This has been exemplified when alluding to drinking water derived from various sources. Not only this, but even if the actual amount of some substance, such as (say) chlorine, is well within the accepted standard in a particular sample, yet if it be in excess of the amount found in other neighbouring (and presumably similar) samples from similar sources, suspicion is naturally excited. Thus, in a series of shallow well waters at Meerut, the chlorine ranged from half to one and a half grains per gallon; in one sample, however, there were six grains per gallon together with a good deal of saline ammonia.

This brings us to the last and most important qualification to be considered with regard to all chemical analyses of water, *viz.*, the nature of the surroundings of the spring or well, the character of the gathering ground, if the water be from a small stream, if from a river the character of its banks (showing whether gross pollution takes place in the immediate neighbourhood), if taken direct from a public supply, or from a house cistern, and if from the latter, its condition, situation, &c. These points, which are in fact merely an extension of the enquiry as to the *kind* of water that is submitted for examination, are of the greatest importance, and can in no case be overlooked. It can be asserted without fear of contradiction (even by the greatest supporter of the value of chemical analysis) that, however good and pure a water may appear to be according to chemical tests, if it comes from (say) a shallow well, or spring, obviously exposed to daily or frequent pollution, such a water is dangerous and unfit for drinking. There is little probability that such a water would pass the chemical examination satisfactorily, but, even if it did, the ocular demonstration of its unfitness must be held to outweigh the negative chemical evidence. "When a water is known to be fouled by sewage, or known to be liable to such pollution, any form of examination is superfluous." (Thresh). It is most important therefore that the analyst should either be himself acquainted with the surrounding circumstances of the place whence the water is derived, or should be fully informed of them. In no case can he afford to disregard such information, and in many instances it will materially affect the conclusions to be derived from his analysis.

With all qualifications, however, chemical analysis remains at present a necessary part of the examination of water, and as Dr. Stevenson said at the Liverpool Sanitary Congress (September 1894), in no case can its results be set aside as illusory.

III.—Indications afforded by Bacteriological Examination.—When precise bacteriological methods were first applied to water analysis, it was thought that the greater the number of germs present the more impure was the water, and that any very large number would, for that reason, render a water unfit for drinking. It is certainly the case that grossly polluted waters do contain enormous numbers of bacteria (such as 200,000 per c. c. in the Seine at Saint Denis); also that the purest waters contain very few (such as 4 or 5 per c. c., in rain water at Montsouris, and 3 or 4 in a deep well in the chalk (Frankland). But between these extremes a *quantitative* test, or mere numeration of the individual germs, is no certain index of the fitness or unfitness of a water, and has been in great measure abandoned for the more difficult, but more rational, *qualitative* examination, by which the different forms or species present are sought to be determined.

Koch states that a good drinking water should not contain more than 100 germs per c. c., but obviously this is intended to be taken with considerable limitation. A deep well water, ordinarily containing only 10 or 20 per c. c., might be dangerously polluted if the germs rose suddenly to 80 or 100 per c. c., without adequate explanation being forthcoming. The circumstances that influence the multiplication of bacteria in water are very complex. The nature of the water, the nature of the bacteria present, the time that elapses between the taking of the sample and the preparation of a plate cultivation, and the temperature at which the water has been kept—these are the chief factors concerned. Unless absolute uniformity of conditions can be obtained (and this is in most cases practically impossible), a comparison of the numbers present in different samples is likely to be very misleading.

Although the mere numeration of germs in a sample is as a rule no more a guide to its character than the estimation of some one chemical constituent, such as the organic matter, there are circumstances when it is of use, and sometimes of great use. (1) The comparative numeration in water from any one source taken at different times will often give interesting results. Thus Heræus found 5,000 organisms per c. c. in a well water that had been but little used during the preceding 36 hours. After the well had been emptied by continuous pumping, a second sample yielded only 35 per c. c. The reason that spring water and water from deep wells constantly drawn upon contain very few micro-organisms is that such water has undergone a natural process of exhaustive filtration, so becoming almost germ-free; but if such a water is allowed to stand (as in a well only used intermittently) great multiplication of germs takes place. (2) Another and more important use for the quantitaative estimation is to test the efficacy of a filtering apparatus, or filter bed. This has been exhaustively done in regard to the London water-supply by Percy Frankland, who shows that the average reduction in the number of germs effected by sand and gravel filtration amounts to 97 or 98 per cent. A particularly instructive example was afforded by the Hamburg and Altona cholera epidemic of 1892 in regard to the water supplies of those towns. Hamburg is supplied with water from the Elbe, taken *above* the city. Altona is supplied from the Elbe *below* Hamburg, and after it has received the sewage of about 800,000 persons. Hamburg water is therefore much purer than Altona water. But in Hamburg the cholera mortality was 1,250 per 100,000, while in Altona it was only 221 per 100,000, the circumstances of the two towns and their populations being almost identical. Had drinking water then nothing to do with the epidemic? And was some mysterious influence or epidemic wave to be sought for? Nothing of the kind. The Hamburg water was distributed "raw"; the Altona water was subjected to very careful sand filtration; the dividing line between the two water-supplies, that is, the boundary between the two towns, is for some distance along a particular street. On the Hamburg side of this cholera was rampant, the Altona side remained free. (This reminds us of Sir J. Simon's instance of the Lambeth Company's supply compared with that of the Southwark and Vauxhall Company in the London epidemic of 1854, the area supplied being the same. The death-rate for the former Company's consumers was 370, for the latter Company's 1,300 per 100,000.) In December 1892 and January and February 1893, however, a sudden recrudescence of cholera appeared at Altona, Hamburg remaining free. On enquiry it was found that the micro-organisms in the Altona water had increased from about 50 per c. c. to more than 1,000 per c. c., clearly indicating that the filtration was not being effectually carried out One of the sand filters had become frozen, and was not able to retain the bacteria. Here quantitative bacteriological examination is evidently of the utmost importance, giving warning that the filter beds are out of order, and pointing to the steps to be taken for arresting an outbreak.

But apart from this periodical examination of a public water-supply, the quantitative test, or enumeration of bacteria present, is no more able to distinguish between the hurtful and the innocent germs than the permanganate process is to distinguish between organic matter derived from fæcal contamination and that resulting merely from dead leaves. Of much more importance is the *qualitative* examination, which seeks to identify the various forms found to distinguish between the normal, naturally-occurring "flora," so to say, of a water, and the added, abnormal, and possibly pathogenic forms: and especially to discover the presence of the specific poisons of enteric fever and cholera.

The important point is to detect the pathogenic forms known to exist in water. These include first and foremost *Bacillus typhi abdominalis* and *Spirillum choleræ Asiaticæ.* Each of these has numerous imitators (of which it might be said that Cæsar and Pompey are very much alike, especially Pompey), forms that resemble the real article so much and in such a manner that it is (I think) impossible to believe them to be really distinct species. *B. coli communis* is the most noteworthy, and has definite claims to pathogenic properties of its own, as well as a very close relationship with *B. typhi.* Besides these, *B. anthracis* has been found under circumstances pointing to the water in the well whence it was obtained being the cause of the disease in sheep. *B. tetani* and *B. tuberculosis, B. pyocyaneus, B. septicus, Staphylococcus pyogenes* and *M. cereus albus* have also been found in water, although whether such water has been instrumental in causing the diseases connected with these organisms has not been demonstrated.

Detection of Bacillus typhi abdominalis.—Numerous methods have been devised for the isolation of Eberth's bacillus, none of which can perhaps be absolutely relied on for eliminating all bacteria except this one particular species. But there are several ways in which all kinds can be got rid of except two or three, and from such a small number of forms further cultivation can readily isolate the forms, at present generally accepted as distinct species, known as *B. typhi abdominalis* and *B. coli communis.*

There are four cultivation tests that can be applied, without difficulty, to distinguish between them. From the plate culture already made, and containing probably only colonies of *B. typhi* and *B. coli*—

(1). First inoculate into a test tube of ordinary gelatine peptone in a *melted* condition, shake well, allow this to solidify, and maintain at 64° to 68° F. After 24 to 48 hours numerous conspicuous gas bubbles are found throughout the solid medium if *B. coli* is present; the typhoid bacillus produces no such fermentation (Frankland).

(2). Inoculate into sterilised milk* and maintain at the body temperature (37° C.); *B. coli* coagulates the milk in 24 to 48 hours, and renders it strongly acid: *B. typhi* makes it slightly acid, and never causes coagulation.

(3). Make a culture in ordinary alkaline beef broth containing one per cent. peptone, and incubate at 37° C. for 24 hours. To 10 c. c. of this add 1 c. c. of a solution of potassium or sodium nitrite (0·02 gramme in 100 c. c.), and then a few drops of strong sulphuric acid. If indol is present, a rose to deep red coloration is produced (nitroso-indol nitrate). This occurs with *B. coli,* not with *B. typhi.*

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* Prepared by being heated to 58°—65° C. for one to two hours on five to eight successive days: the milk is sterilised without being coagulated or altered.

(4). In 25 per cent. nutrient gelatine kept at 37° C. (fluid) *B. coli* grows rapidly, forming a pellicle on the surface in two or three days ; a precipitate is also deposited, but the gelatine remains perfectly limpid. *B. typhi* also grows rapidly, but makes the gelatine uniformly turbid soon after 24 hours (Klein).

The above four tests, together with the differences in the morphological appearances of the two organisms, are at present the means to be used for differentiating between them. They are all of easy application. The question of the specific distinction between these two organisms, or whether they are really varieties, or evolution forms, of the same species, is not here entered on ; neither is it necessary to refer to the very numerous "pseudo-typhoid" bacilli, which so greatly resemble Eberth's bacillus. It is impossible to believe that they are all actual distinct "species" in the ordinary biological acceptation of the term.

Detection of the cholera spirillum.—Koch's plan is the following : Take 100 c.c. of the water to be examined, add one gramme peptone and one gramme common salt, incubate at 37° C. After 10, 15 and 20 hours, prepare agar plates from this mixture, and also examine the mixture itself microscopically for spirilla. Any colonies which appear on the agar plates and resemble those of the cholera spirillum are examined microscopically. If any comma-shaped forms are found, fresh inoculations are made, and the cultures tested for the indol re-action, and for the effects of inoculation into guinea pigs.

Of the many comma-shaped and spirillar forms found in water, Koch states that none give the indol reaction, nor the characteristic pathogenic effect on guinea pigs, except *Spirillum choleræ Asiaticæ.* The indol reaction has been mentioned above. Pfeiffer's method of experimenting on guinea pigs is to take a full needle loop (about 1·5 mgms.) of the surface growth of an agar culture, distribute it in one c. c. of sterile broth, and inject this into the peritoneal cavity of a guinea pig. This should be a fatal dose for an animal of ordinary weight, 300-350 grammes, causing a rapid fall of temperature resulting in death ; for a larger animal a larger dose must be given.

But lately Sanarelli has isolated 32 vibrios from water, morphologically distinct from each other, all giving the indol reaction, some the cholera-red reaction, and four extremely pathogenic to animals, producing symptoms indistinguishable from those considered typhical of cholera infection.

Sanarelli considers that pathogenic forms may become attenuated into mere saprophytes by residence in an unfavourable medium. He actually brought this about by keeping an extremely virulent vibrio in boiled river Seine water for a month, at the end of which time it had lost its pathogenic properties, and did not give the indol reaction, though morphologically it remained unchanged for three months. More recently Metschnikoff (1894) has also produced attenuation in form and in pathogenic properties of the cholera vibrio ; he considers that the cholera vibrio is itself variable, but that artificial variations acquired under the influence of external conditions may be constant.

Besides these recently differentiated forms are those longer and better known allied species, *S. Finkleri* and *Vibrio Metschnikoffi.* The former grows much more rapidly than Koch's comma bacillus in gelatine, causing liquefaction after 24 hours instead of on the 3rd or 4th day ; the latter does not occur in water.

This is not the place to discuss the question whether the respective specific contagia of enteric fever and of cholera are definitely and finally *fixed* in the forms known as *Bacillus typhi abdominalis* and *Spirillum choleræ Asiaticæ* respectively, or whether these forms are not quite definite, not fixed *species*, but possibly predominant varieties, or stages in the evolution of the disease-producing organism. There is much to be said in favour of the latter view, which to my mind is both more reasonable and more in harmony with clinical and epidemiological observation. As far as water analysis is concerned, we have to make ourselves acquainted as far as possible with the ever developing, and at the same time frequently varying and discrepant, observations of bacteriologists, and apply them as well as we can under the circumstances in which we are placed and with the means at our disposal.

IV.—Practical Suggestions for Rapid Examination of Water, Chemical and Bacteriological.—The most important points to determine in examining a water are (1) its physical characters ; (2) its relative freedom from, or pollution with, organic matter ; (3) its freedom from, or pollution with, excremental matter ; (4) the presence of any large number of putrefactive organisms ; (5) the detection of the specific organisms of enteric fever or of cholera. These remarks are expressly intended to apply only in cases where no laboratory arrangements are available, and where only the simplest apparatus and ordinary chemicals are at hand ; as well as some such cultivation means as are described below.

(1.) For the *physical examination* no apparatus is required, only a few minutes are needed for its performance, and it should never be omitted. If a water smells or tastes badly, no further examination need be proceeded with ; it is unfit for use in that state.

(2.) For the *organic matter* (which, in the absence of nitrites, may be taken to be the same as the oxidisable matter), a graduated burette, standard permanganate solution, dilute sulphuric acid, and two or three glass tumblers are all that is required, according to the directions in Wood's Cabinet. The experiment should last four hours ; but a *relative* determination (some pure water being used for comparison) may be made in half an hour.

(3.) As tests for *excremental pollution*, the determination of the chlorine and the saline ammonia is both rapid and easy. For the chlorine, either 16oz. in a measure-glass, or 8oz. in a tumbler, may be taken ; a graduated burette, standard nitrate of silver solution and a 5 per cent. solution of monochromate of potash are required ; the experiment takes five minutes. Wood's Cabinet contains all that is needed.

For the ammonia, take eight ounces of water in a tumbler, add 20 grain-measures of Nessler's solution by the small pipette ; if no yellow coloration is produced, there is less than 0·006 per 100,000 ; if a distinct yellow colour is given, followed by a yellowish precipitate on standing, there is from 0·006 to 0·01 per 100,000 ; while if there is a very marked yellow colour, rapidly developed and deepening in a few minutes, the quantity of saline ammonia is over 0·01 per 100,000. No water should contain more than 0·006 without explanation being forthcoming, as previously stated. This test is very rough, but takes only a few minutes to perform, and is of great value in conjunction with the determination of chlorides, as before mentioned. Nessler's solution is the only test solution required (it is not at present furnished in Wood's Cabinet, but can be easily prepared from iodide of potash, perchloride of mercury and caustic soda) ; if standard ammonium chloride solution be available as well, of course greater accuracy can be arrived at.

The ordinary *qualitative* examination (as provided for in Wood's Cabinet) does not take more than half an hour to perform, and in addition to the above tests will enable any one with very slight skill or practice (*if due care only be exercised*) to give in general terms an opinion on the fitness or the reverse of the water for drinking, with reasons for the same, as previously mentioned. All the chemical re-agents required are available in any dispensary (except perhaps monochromate of potash). There is no doubt that in *ordinary cases*, for the determination whether a water is pure or impure, fit or unfit, such a rapid and simple examination is sufficient ; a polluted water will be detected and condemned, which is the most important point. But specific contamination by very minute quantities of specific disease poison would not be detected unless accompanied by appreciable organic pollution as well.

(4.) For a simple bacteriological examination as to abundance or scarcity of putrefactive organisms, a gelatine plate cultivation is sufficient ; rapid and extensive liquefaction points to their presence in abundance.

(5.) For detection of the typhoid bacillus and cholera spirillum directions have already been given, for simple and easy tests to be applied. The difficulty lies, not in the application of these tests, but in their proper interpretation.

As a portable, cheap, and for rough and ready work fairly efficient apparatus, I bring to your notice a hot air steriliser, steam steriliser and incubator, within which may be packed test tubes of gelatine and agar, glass plates, and all the absolute essentials for a rough bacteriological examination. Nearly everything concerned can be made by a native workman anywhere, and two or three kerosine oil tins furnish most of the material required. The cost is about 10 or 12 rupees. With this, and the simple chemical apparatus and universally obtainable re-agents, already specified (furnished in Wood's Cabinet), a chemical and bacteriological examination of water can be made which, I venture to think, rough and ready as it is, would be within the reach of everyone, and perhaps more valuable than either a chemical, or a bacteriological examination alone, even if on a much more extended scale. Lastly, it must be borne in mind, that (1) although bacteriological examination can give *positive* evidence of specific disease contamination, and lead to the condemnation of a sample, which chemical examination might fail to detect, a *negative* result from bacterial cultivation does not prove that the specific contagia are absent ; and (2) although chemical examination is powerless to detect the specific contagia, it must be an extremely rare occurrence that they should gain access to water without being accompanied by some animal organic contamination, easily appreciable by chemical tests. Wherefore, it may be asserted, that chemical examination cannot safely be abandoned in favour of bacteriological examination, even though the necessity for this latter be fully admitted. The *general* wholesomeness or the reverse of a water is revealed by chemical, *specific* contamination by bacteriological, methods.

ON THE MICROBES OF INDIAN RIVERS.

BY E. H. HANKIN, M. A.

One of the oldest and most serious objections that has been offered by Indian experience to the view that cholera is a water-borne disease, is the fact that, so far as the larger Indian rivers are concerned, the disease is known to travel up-stream, and with the doubtful exception of one or two bathing-ghâts at the time of *melâs*, their water is not known to be capable of transmitting the disease. Yet cholera corpses are frequently thrown into the rivers and natives are often to be seen drinking their water.

The following observations, at least, suggest an explanation of this fact. The scarcity of microbes in Indian river water about to be described must, in part at least, be due to a destruction of microbes, which would appear to be more energetic in Indian than in European rivers. It is possible that the cholera microbe, on arriving in the water of rivers like the Jumna and the Ganges, becomes rapidly attenuated or destroyed. I have twice isolated the cholera microbe from the water of the Ganges, in each case from specimens of water taken from bathing-ghâts during a *melâ*. In the first case, at Allahabad, the microbe was tested and found not to be in a state of full virulence, as it only killed a guinea-pig in 32 hours. In the second case, a guinea-pig was killed after 13½ hours. A cholera microbe, taken from a drain coming from a village on the banks of the river about a mile above the ghât, killed guinea-pigs in 4½ hours. In the other case, the cholera microbe was isolated from water taken from a ghât near Bijnor, but was not tested as to its virulence.

My observations have been made on the water of the Jumna, Ganges, Gogra, and Goomti. In the case of the Jumna, I have made a series of observations during the whole of the year 1894, with the help of Mr. Crawshaw, the Agra Municipal Engineer, to whom I owe my best thanks. A parallel series of observations have been made on the Agra Municipal water, which have shown the high degree of purity that this water possesses. The process of analysis consists essentially in adding a measured volume of the water to some melted meat jelly, and afterwards in counting the colonies that develop in this substance. The first part of the operation has been carried out by Mr. Crawshaw during the latter part of this year, while I have merely had the duty of counting the colonies. I hope in time to be able to teach other Municipal Engineers to carry out such bacteriological analyses, which, for the purpose of knowing whether their filters are removing microbes, is greatly superior to the more cumbersome aud expensive method of chemical analysis.

The results of these bacteriological examinations are shown on the accompanying chart. The figures for both the Jumna and for the standpost water are given, as they mutually act as a sort of control for each other, in that the relative constancy of the results for the filtered water indicate that the variations in the results for the river water are not simply due to variations in the quality of the nutrient medium employed.

As a culture medium, I am obliged to use agaragar instead of nutrient gelatine. It is commonly supposed that in the former substance many colonies do not develop, and that, therefore, it is not so accurate as the gelatine. But I venture to think that I have avoided certain sources of error in my technique. For instance, I do not pour the melted agaragar out into "Petri's capsules," but leave it in the tubes, thus in great degree protecting it from the harmful influence of evaporation which tends to be greater in Indian than in European laboratories. It might be thought that when I find only 300 microbes per cubic centimetre in the water of the Jumna at Allahabad 2½ miles above the site of a *melâ*, the result was due to some error in my method of observation. But on the same day I examined stagnant water from a small tank near the site of the fair and found 3,600,000 microbes present per c.c. In a drain in the Agra Sadr Bazaar I found 6,600,000 microbes per c.c. These figures are perfectly comparable to what has been found by European observers for stagnating water. Further the same method of sand filtration is used in Indian as in European waterworks, and my results are extremely similar to those obtained in Europe. In Allahabad, on the date referred to, I found that the standpost water contained 160 microbes per c.c. The Agra pipe water generally contains from 10 to 20 microbes in the same bulk. The Lucknow water averages 60. The Benares water was examined on one occasion and was found to contain 6 microbes per c.c. Here, however, are exceptionally favourable conditions, as the filter beds can be used for more than a month without showing signs of becoming blocked. The Cawnpore Municipal water has been found to contain 400 microbes in a cubic centimetre. The pipe water in Naini Tal was found to contain 48 microbes per c.c.

In the chart I have incorporated the results obtained by Proskauer for the Spree at the intake of the Berlin waterworks, and by Frankland for the Thames at Hampton.

It will be seen at a glance how much better the water of the Jumna is from the bacteriological standpoint than that of either of the European rivers quoted. During the hot weather the Jumna is seen to contain less than a thousand microbes per cubic centimetre. Only during the rains do the figures rise to as many as 9,000 per c.c. In the case of the Thames the worst time of the year is seen to be during the winter. The Spree water contains most microbes near the beginning and near the end of the winter. The fall during the winter is presumably connected with the fact that the river and the surrounding country were then covered with ice. During the latter part of the hot weather (June), the Jumna is usually completely diverted at Delhi into the Delhi-Agra canal ; indeed the timbers forming the dam are carefully caulked to prevent any water escaping. Consequently the water present in the river at that time at Agra is merely the ground water that, in the descent of the river, gradually comes to the surface. Owing to the extreme dryness of the country at that time, it is safe to assume that not a drop of water comes from the surface of the land. At this time the river level is lowest (reaching to 484 feet above sea level, as compared with 497 feet reached during the rains), consequently the microbes in the river water are most exposed to the disinfecting action of sunlight and to the oxidising and other processes that contribute to the "self-purifying power of rivers." There can be no doubt that these processes, going on as they do at a far higher temperature than happens in European rivers, are far more energetic, and in this way the relative freedom from microbes of Indian rivers can be explained. During the rains much refuse is washed into the rivers from the surrounding country, but here the increase in number of microbes is not so great as might be expected, as a great part of the water consists of melted snow from the Himalayas.

The Goomti at Lucknow is a deep and narrow river, and, if it keeps this character at other places, its water is not likely to be so well exposed to the purifying influence of air and light. I found that its water contained between 3,400 and 13,000 microbes per c.c. at different points during the hot weather.

The water of the Ganges was examined on two occasions at Allahabad. It was found to contain 1,800 and 1,250 microbes per c.c. respectively. The same river was examined at the intake of the Benares waterworks and was found to contain 950 microbes per c.c.

The Gogra was examined after the rains while crossing in a boat at Ajudia. In half-a-dozen examinations results between 350 and 1,200 microbes per c.c. were obtained.

These results may appear to have some bearing on the question of the disposal of sewage in India. If sewage can be thrown into European rivers where the processes of destruction of microbes go on at much slower rate than in India, and where the rivers in consequence contain often as many as a thousand times more microbes than does the Jumna during the greater part of the year, then it would appear that *à fortiori* it would be safe to dispose sewage by throwing it into rivers. But it would obviously be a most dangerous experiment in the case of rivers in the hills and in other places whose waters are known to be capable of transmitting cholera, and in any case, owing to the difference in the quality of the microbes likely to get into Indian rivers in this way, it is advisable to keep up a higher standard of purity than is permissible in Europe.

Owing to the fact that river water in the North-West Provinces is in general not known to transmit cholera, and that the wells are known to have this power, and owing to the fact of the greater richness of well water in microbes than river water, I should have no hesitation in recommending anyone to drink the water of the rivers I have mentioned, with the possible exception of the Goomti, in preference to the water from ordinary wells.

(*See page 242a for diagram.*)

CHEMICAL ANALYSIS OF POTABLE WATER IN INDIA.

BY N. S. RUDOLF, B.SC.

It is of the utmost importance, if chemical analysis is to be of any use for sanitary purposes, that it shall be possible to deduce a sound opinion as regards the potability of the water from the results obtained. Our methods of analysis are very accurate, and it is not likely, even if it were desirable, that more accurate means could be devised. A sample of water, if examined by two different chemists possessed of fair manipulative skill and experience, usually gives results approximating very closely to one another. Unfortunately when we come to the deduction of conclusions as regards the potability of the water from the results of analysis, we find that such a satisfactory state of affairs does not exist.

Two chemists frequently will be found to hold very different opinions as regards the potability of the sample in question. Misunderstanding also occurs from the use of ambiguous terms in describing the quality of the water. No uniform system of reporting has been adopted, and consequently it is difficult to use the results of chemical analysis for statistical purposes. The use of some standard of potability is strongly indicated. Thus it is seen that differences of opinion are sometimes more apparent than real, and are due to the difficulty of describing the quality of waters accurately in words. It is now our task to investigate the causes which lead to different opinions being held by experts in judging of the quality of the same sample of water from the same chemical data, and how can these differences be avoided.

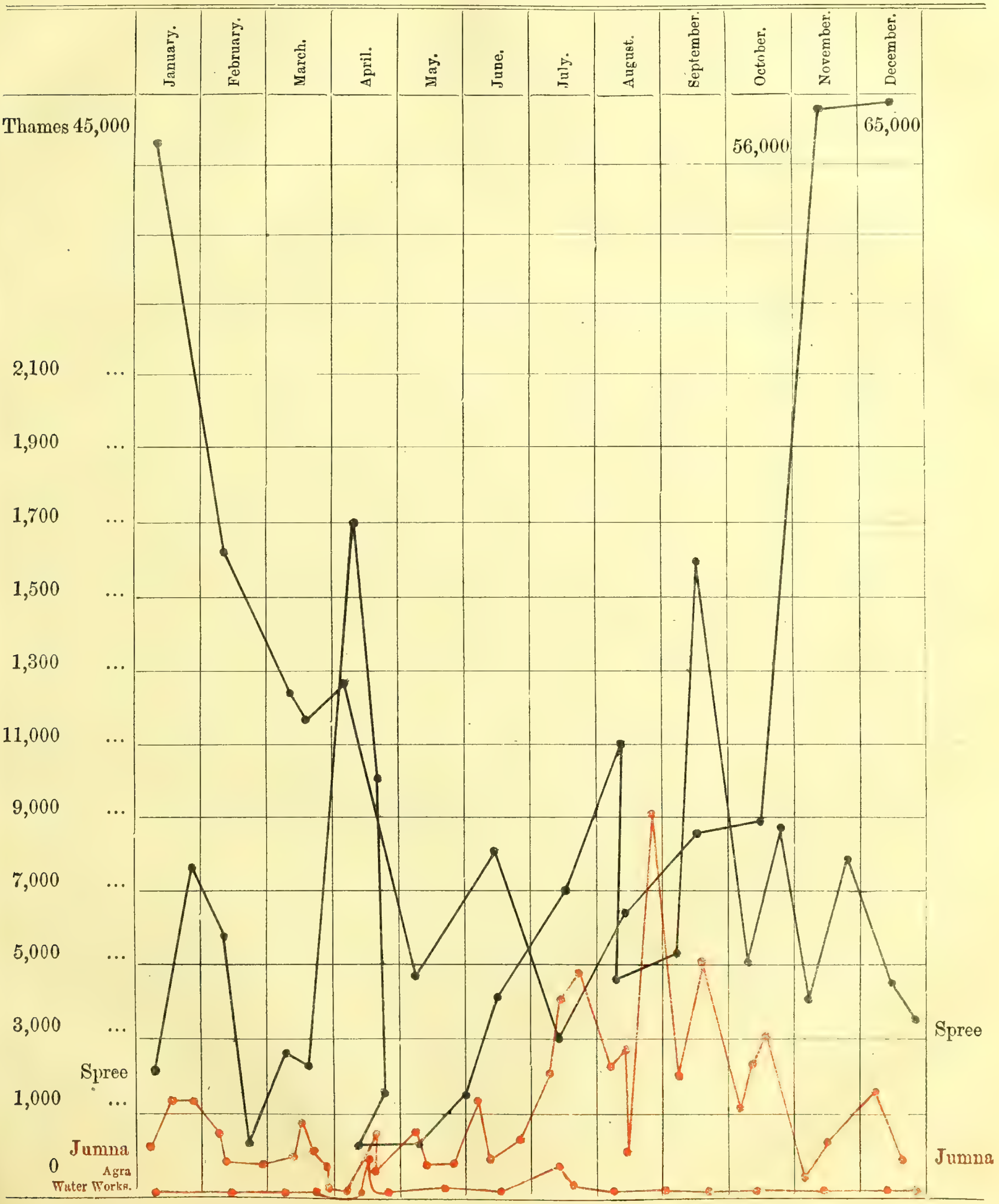
It will be necessary to briefly review and consider the respective importance of the constituents from the amounts and presence of which an opinion regarding the quality of the water is to be formed. The free and albuminoid ammonia being almost always derived from matter of animal origin are undoubtedly constituents of much importance.

The albuminoid ammonia is estimated by Wanklyn's process and ought to be reported as nitrogen. It represents the total organic nitrogen. Considerable importance attaches to the relative proportions in which the two forms of ammonia occur, as it has been shown that these ratios are essentially different according as they are derived from vegetable or animal matter. Messrs. Tatlock and Thompson, in their recent paper read before the Scottish Section of the Society of Chemical Industry, draw attention to the fact that waters derived from deep bore hole frequently contains a proportion of free ammonia which would condemn them for potable purposes were they not derived from an impeachable source ; the same observers also point out that chalybeate waters of undoubted purity often contain a high proportion of albuminoid and free ammonia. Varying opinions are held as regards the value of the evidence afforded regarding the purity of a water by the detection and estimation of nitrates and nitrites. They undoubtedly indicate previous sewage contamination in most cases, as they are derived from the oxidation of the ammonia brought about by ferments. The ammonia under the influence of a ferment becomes oxidized to nitrites, and then further to nitrates ; it is not certain whether the same ferment can oxidize ammonia into nitrites, and nitrites into nitrates ; or whether two ferments exist, the one capable of forming nitrites from ammonia, and the other converting the nitrite into the nitrate. Formerly importance was only attached to the presence of nitrites, which indicated that some partly-oxidized sewage matter was entering the water ; but when nitrates only were found, it was considered that the oxidation which the water had undergone must have effectively destroyed all pathogenic micro-organisms. Mr. Stoddart, however, in a paper in the Analyst in the earlier part of this year, proved very conclusively that the oxidation of ammonia into nitrates by filtration through soil is usually a very rapid process, and he points out that the nitrates are very important factors in judging of the purity of a water.

It appears quite possible that a water contaminated with sewage may have undergone sufficient filtration and nitrification to convert all ammonia into nitrates, and yet from the presence of undestroyed bacteria, it may be utterly unsuitable for potable purposes. Again, should any delay occur in examination of a sewage contaminated water, the ammonia may oxidize into nitrates in the bottles. Thus recently I had occasion to examine the water of a well situated in close proximity to a native latrine. The water was examined on November 3rd, and contained 0·510 pints per

Number of microbes present each month in certain Indian and European rivers.

European River *black.* | Indian River *red.*



100·000 of free ammonia. After reading Messrs. Tallock and Thompson's paper, I redetermined the ammonia on November 25th, and found the water to contain ·006 of pints per 100 000 free ammonia, while the nitrates had correspondingly increased. These same observers give an instance of a mixture of Lock Katrine water and sewage containing over ·3 grs. per gallon, which lost 0·04 grs. per gallon daily. These results show the necessity of forwarding water samples as quickly as possible to the chemical examiner.

The determination of chlorine in chlorides is, in my opinion, almost useless for detecting admixture of sewage or impurities of animal origin. Waters contaminated with sewage undoubtedly always contain chlorine, but as sewage only contains on the average 5 grs. per gallon, and as chlorine is a normal and very variable constituent, it is evident that only a very large admixture of sewage matter would render the chlorine in any way abnormal. Thus a water might contain 10 per cent. of ordinary sewage, giving 0·5 per gallon, an amount which is not unusual in a pure sample. No doubt in judging of the general suitability of a water for potable purposes, some little account should be taken of the amount present, as, if present in large quantities, it may render a water unpalatable and unwholesome. But here the taste will usually be the best criterion. The determination of the oxygen absorbed is of minor importance. Solids in suspension and hardness are all of minor importance, but some account must be taken of them in judging of a water intended to be used for town supply. The amount of solids in suspension, as shown by the turbidity, is of more interest to the water engineer than to the sanitarian.

Valuable conclusions can sometimes be drawn from the physical appearance of a water. Thus a brownish water usually indicates a mossy or peaty source, or, in this country, it may have passed through jungle. A greenish or yellow well water is usually impure, but the converse does not hold that a colorless or bluish water is necessarily pure. Some of the most deadly waters I have seen were clear, bright and sparkling. Effluents from sewage forms are usually of this appearance. Again, the smell of the water is sometimes a most valuable criterion of its purity. A distinct sewage-like smell condemns a water as effectually as a complete analysis would do.

I will now proceed to the consideration of the causes which lead sometimes to such different conclusions being drawn from these chemical data. First and foremost I would put the lack of reliable standards and the want of a scale of potability. It is by no means an easy matter to pronounce an opinion on a sample of water from the consideration of the results of chemical analysis. There is a great tendency to form an opinion on the amount or presence of a single constituent which leads to erroneous conclusions. Thus, if a water be judged on the amount of nitrates it contains without regard to the other constituents, a pure water from a district where the soil contains much nitrates would be considered as impure, whereas the nitrates would have been derived from the soil and not from any admixture of sewage. Again, in looking over analysis, unless one has constant practice, one is apt to become confused and cannot take in the full import of all the figures. One constituent can only be considered at a time and duly weighed, and it is difficult for the mind to put together and evolve from all these factors one opinion. The next question that arises is, on what principles should a scale of potability be drawn out. It must assign the proper value to each constituent. The greater the importance of a constituent as evidence of contamination, the more influence it must have on the final opinion. The system must be simple and easily applied, and every constituent and character of the water must be taken into consideration. The scale of potability as devised by Mr. Wigner fulfils these conditions in a high degree. It will be seen by an inspection of this scale that each constituent has a definite value attached to it. The sum total of these values indicates the impurity of the water.

For convenience sake waters are divided into three classes, as follows: First class waters whose value on scale of potability are under 20; second class those above 20 and under 40; and third class above 40 and under 60. A very impure water might have a value 150, but this would not often occur. The representation of the quality of a water by a single figure is especially useful when it is necessary to compare the quality of several waters one with another. This is frequently necessary in choosing from what sources a water supply shall be drawn. Again, when a water supply has to be examined from time to time with a view to ascertaining if a proper standard of purity is being maintained, a table can be prepared showing the rise and fall in purity at a glance.

The accompanying table in illustration of this is taken from Blythe's "Analysis of Foods." In schemes for municipal sanitary improvement these single-figure representations of purity are of value. On the map of the municipality every well may, after analysis, be marked with its figure representing the potability of the water. The connection between outbreaks of disease and impure water may thus be traced.

The whole question of water analysis in its relation to sanitation is put on a thorough statistical basis. Again, the use of ambiguous terms is avoided, reports made by a chemist who has ceased to officiate are perfectly intelligible to his successor.

But we must remember that while this system has many advantages, it has its drawbacks. Mr. Wigner's scale of potability is not perfect. It gives undue prominence perhaps to some constituents.

No attempt has been made as yet, I believe, to include the results of bacteriological examination in the scale of potability, and it would be a difficult matter to do so. For it is quite possible for a water to contain sufficient cholera or enteric poison to make it most dangerous, and yet chemical analysis might fail to detect any impurity. Nevertheless, some account might be taken of the number of microbes present. I would suggest that 50 microbes per cubic centimeter might have a value of one on the scale, but this is a figure which should be fixed by the bacteriologist.

The source of the sample and environment must be carefully considered. A sample of water from an artesian well, which I once analysed, contained 2·0 pints per 100·000 of free ammonia. This would give a value of 200 on the scale, and the water would be condemned as absolutely unfit for potable purposes.

But this water was free from any contamination with sewage matter, the ammonia being derived probably from a bituminous shaly strata through which the bore passed.

In the case of such a sample I would assign no value to the free ammonia, and would make a note of the reason for my having done so. Again, I recently analysed a water from a deep well situated in close proximity to an old nitre godown. The ground all around was saturated with nitrates.

The water was pure, but the amount of nitrates and chlorides which it contained was sufficient to point to sewage admixture, had the environment been unknown.

This question of sewage admixture leads to another point, which has not, I believe, received the attention it deserves.

It is this: Most of our knowledge of waters and our views as regards what is a potable water are founded on conclusions based on analysis of sewage. Dr. Wallace had analyses made of Glasgow sewage at various hours of the day. Dr. Frankland also did some valuable work on the composition of London sewage. The standards of potability given by the authorities are based on the average composition of sewage in most cases. From these analyses most valuable conclusions have been drawn regarding home waters and the probable amount of sewage admixture in contaminated samples.

But in this country we have no such sewage except in a few of the largest towns. In judging of the character of Indian waters this should be taken into consideration. The amount of nitrates present in a water has been shown to be of the utmost importance, pointing, as it almost always does, to previous sewage contamination.

But in India where, in many places, the soil is impregnated with nitre, it appears to me that its presence in quantity is not by any means a certain indication of previous contamination. The nitre may have been formed from the air, or all the organic matter from which it was derived may have disappeared at some remote period. Thus it is evident that European standards cannot be used without modification in judging of the waters of this country. This view, however, is open to contradiction. It would, in my opinion, be useful, if some rules could be drawn up for guidance in judging of the potability of Indian waters.

Hence it seems to me that the analyst, in addition to making the analysis and recording the properties of the water, should also give an opinion as regards its potability. Chemical examiners in this country have constantly to make such analyses, and from their experience it is easy for them to decide on the quality. Again, the analyst is often influenced in his opinion by what he sees in making the analysis. The appearance of a precipitate, or some trifling property, will often tell much, but which cannot be described, in the results of analysis.

The argument in favour of the medical man in charge of the water supply drawing his own conclusions from the analytical results, is usually that it is difficult for the analyst to give his opinion exactly in words, and misunderstandings are apt to occur. But when the potability is expressed by a single figure, this argument falls to the ground. From what we have now seen I think it must be evident to most of us—

1st, that Indian waters cannot be judged of by Western standards ;

2nd, that the use of a scale of potability is a great help to the sanitarian, and all who have to do with questions of water supply, as well as to the analyst ;

3rd, the analyst, or chemical examiner, should be furnished with all possible information as regards reasons for analysis, source, and environment. He should also be told on what his opinion is wanted ;

4th, the water sample should be forwarded to the analyst with as little delay in transit as possible.

To Dr. Gregg, the Sanitary Commissioner for Bengal, must be given the credit of introducing a scale of potability and a simple and intelligible form for the water examiner to report the results of his analysis and the conclusions drawn from them. The rules to be observed are embodied in Sanitary Commissioner for Bengal's Circular No. 342 of 25th June 1894.

In the same, suggestions are given as regards the kind of information which will be of use to the water examiner, and directions are given as regards packing, despatch, and the collection of the samples.

This brings us to another point : the sampling of water. If chemical analysis is to be of any value, the sample, when it reaches the laboratory, must represent the source. Chemists know only too well that this is not always the case. The sample bottle may have been dirty ; the water may not have been properly collected ; the cork may have been a bad fit and dust worked its way into the space, which, when the cork is removed, falls into the bottle ; or, again, the cork may have been covered with sealing wax very difficult to remove completely ; a delay may have occurred in transit. All this is avoided ; exact directions are laid down for collection of samples from all kinds of sources—wells, tanks, rivers, etc. The sealing of the bottles is done in this way. Over the stopper is put some cotton wool, and over this a piece of cloth. The whole is tied round with tape and the seal affixed on the knot of the tape on the cloth. The use of the cotton wool prevents entrance of foreign matter, and the cloth insures that only on breaking the seal can the stopper be removed. Specially cleaned bottles are issued, packed in boxes of a special construction, which insure immunity from breakage. The bottles are prepared by thoroughly cleansing with alkali and acid. They are then rinsed with water, and finally sterilized by the use of a steam jet. The cotton wool and cloth are fixed over the stoppers before despatch. This system appears to answer well, and the work is much simplified.

The standard of potability used has been found not to be altogether perfect, but, as a temporary measure, it has done useful work. It is not very well adapted to suit Indian waters, as it was drawn up on home standards based on analysis of sewage.

MR. WIGNER'S SCALE OF POTABILITY.

Appearance in 2 ft tube :—		
Colour, blue		0
„ pale yellow		2
„ green		2
„ dark yellow		4
„ dark green		4
Suspended matter to be added to valuation of appearance :—		
For traces...		1
„ heavy traces ...		2
„ turbidity		4
Smell when heated to 100° Fahr :—		
Vegetable matter ...		1
Strong peaty		2
Offensive, of animal matter ...		4
Chlorine in chlorides ...	5 grs. per gal.	= 1
Phosphoric acid as phosphates—		
Traces= 2. h. traces = 4. v. h. traces		= 8
Nitrogen in Nitrates ...	100 gr. per gal.	= 1
Ammonia ...	005 gr. „ „	= 1
Albuminoid ammonia ...	001 gr. „ „	= 1
Oxygen absorbed in 15 minutes at 80° Fahr.	002 gr. „	= 1
„ „ 4 hours	010 gr. „	= 1
Hardness before and after boiling added together	5°	= 1
Total solid matter	5 gr. per. gal.	= 1
Heavy metals	s. traces	= 6
„ „ ...	h. „	= 12
Microscopical results—		
Vegetable *debris* in small quantity ...		4
„ „ large „ ...		8
Diatoms and bacteria in small quantity		6
„ „ large „		12

Hairs and animal *debris*, 10 to 20 according to the quantity observed.

DISCUSSION.

W. H. Gregg (Calcutta) said he wished to make one observation upon a conclusion drawn by Mr. Hankin, *viz.*, that as he found so few microbes in the water of the river Jumna at Agra, therefore it was unobjectionable to pass polluted water into our large rivers. He believed that the passage of such polluted waters into the rivers of the Eastern Himalayas had frequently given rise to cholera outbreaks. He referred to his own paper upon the subject in this section.

Jogendra Nath Datta (Calcutta) said his observations on Hughli river water agreed with those of Mr. Hankin. The number of microbes found in Hughli water varied from 2·000 in the dry season to 12,000 in the rains per cubic centimetre

N. S. Rudolf (Saran) did not agree with Surgeon-Major Davies as to the value of chlorine in waters of India ; in his opinion the estimation of chlorine was useless for sanitary purposes.

S. Aiyer (Trevandrum) agreed in thinking that a revised standard for water analysis was needed. He knew of water chemically good which had been injurious to those who drank them.

The President said that in judging the value of a water, the sanitarian must take into account the conclusions of both bacteriologist and chemist. Dr. Davies had shown that it was possible, with a cheap and simple apparatus, to make a reliable examination. He agreed so far with Mr. Rudolf that for Indian waters an excess of nitrates and chlorides might often be due simply to soil peculiarities, and a committee might well meet to draw up a report on this matter, which would be of great value. As regards Mr. Hankin's paper, he would ask all to note carefully that *his conclusions are applicable, not to the rivers of India generally, but only to those of immense volume fed by the snows of the Himalayas.* His observations that with the first floods the number of microbes so increased notwithstanding the enormous dilution and that they diminished during the hot dry season were of great value and accords with observations on the spread of cholera. In Madras most rivers were short lived, being torrent-fed from distant hills. To maintain irrigation, surface water was arrested by *bunds* on every available slope, and only after the overflow from these has passed from tank to tank did it reach the river bed. In affording guidance to Engineers it was necessary to remember to what particular rivers Mr. Hankin's observations referred. Self-purification of rivers depended upon the concentration of the contaminating matter, this was measured by the extent of the "dilution," and beyond a certain limit this means of purification becomes *overtaxed.* Therefore Mr. Hankin's conclusions must be *accepted only side by side with his definition of the class of rivers from which his data have been drawn.* Was there not a danger that successive increments of defiling matter might maintain a degree of concentration in which self-purification would be either *nil* or incomplete ?

On the subject of filtration he said that they all knew under the most perfect conditions only 99 per cent. of microbes can be arrested. What becomes of the escaping microbe ? Without questioning Koch's opinion as to the Altona outbreak, he reminded them that a recent writer had maintained that those nice distinctions of filtered and unfiltered water areas *did not exist* in relation to cholera spread in Altona and Hamburg, and that even in former epidemics, when the factor of filtered and unfiltered water did not exist, Altona then showed a less cholera incidence than Hamburg, where the soil was damp from proximity of subsoil water, that writer maintained that there cholera lingered longest, and that in higher and drier areas, like Altona, the incidence was less. He was not denying the great value of filtration, but was only calling attention to "the missing microbe." They must look to the bacteriologist and chemist to guide us in our deductions, but their opinions could not be logically regarded as complete or safe unless they accepted the dictum so forcibly laid down by Dr. Thorne Thorne, medical officer of the Local Government Board, England, that *no opinion as to the polutability of water derived from chemical or bacteriological examination could be complete unless accompanied by a careful survey by a sanitarian.*

VACCINATION IN BENGAL.

BY W. H. GREGG, D.P.H.,

Brigade-Surgeon Lieut.-Colonel, I. M. S.

It has been suggested to me that a short account of the system of vaccination in Bengal would be interesting and instructive, not only to medical men generally and others in Bengal and other provinces in India, but also to people in England who take an interest in Indian subjects.

2. To persons unacquainted with the practical working of vaccination in a province like Bengal, it seems an easy matter to inaugurate and carry on a complete and successful system of protection from small-pox, but the difficulty of doing so in Bengal is great, as will be at once apparent when the area, population, and conflicting interests of the people of these provinces are taken into consideration. Any system to be successful in Bengal must, therefore, be simple, effective, moderate in cost, and suited to the requirements of the various classes of the people. Bengal is the largest of the

Indian provinces : it has an area of 151,543 square miles, which is equal to that of the United Kingdom, with the addition of a second Scotland, whilst the population of 71,346,987 is about that of the whole of the United States of America in 1890, together with Mexico. There are forty-seven districts in Bengal, each covering an average area of 3,224 square miles, and containing an average population of 1,503,520 inhabitants, which is greater than the average population of the districts of other provinces, and three times greater than the average population of the Punjab districts, which is 673,124, although the average district area in the Punjab, *viz.*, 3,570 square miles, is about the same as that of Bengal, which is 3,224 square miles. Then, too, the villages in Bengal are more scattered than they are in other parts of India. The supervision of vaccination in Bengal is thus especially difficult, and it is necessary to employ a larger number of workers than in other provinces in proportion to the population.

3. The system of work in Bengal is as follows :— The Department is under the general control of the Sanitary Commissioner of the province, who is assisted by three Deputy Sanitary Commissioners, who are covenanted members of the Indian Medical Service. The district is the unit of administration, and the Civil Surgeon of it is the responsible executive officer, the entire district staff being under his supervision and control. He works in consultation with the District Magistrate and is assisted in the matter of inspections by Assistant Surgeons and Civil Hospital Assistants, the latter of whom also vaccinate in the immediate neighbourhood of their dispensaries, as well as at the dispensaries which are vaccination centres for free vaccination. There is also a Government Inspector of Vaccination in each district, who is the right-hand man of the Civil Surgeon in all matters relating to vaccination, and a Government Sub-Inspector for each sub-division. The principal duty of these officers is to be continually on the move checking the work of the vaccinators. The Inspector also every now and again applies a test to the work of the Sub-Inspectors. An Inspector's pay ranges from Rs. 30 to Rs. 40 a month, and a Sub-Inspector gets Rs. 25 a month. Both are allowed the travelling allowance admissible under the Civil Service Regulations to officers of their class. The Inspectors are appointed by the Sanitary Commissioner from amongst the Sub-Inspectors who are recruited from the rank and file of vaccinators on the nomination of the Civil Surgeon, who makes his selection from amongst the most intelligent and deserving men specially noted for their tact in dealing with local prejudices. Occasionally outsiders are appointed when it seems desirable, in the interests of the public service, to appoint them.

4. The actual work of vaccination in Bengal (except in municipal areas, where vaccination is compulsory and is performed free by vaccinators paid by the municipal authorities) is performed by licensed vaccinators, who are authorized to charge two annas for every successful case. Their work lies in the rural areas of the province. The selection and appointment of these men is eft to the discretion of the Civil Surgeon, who selects them from amongst men of good caste and character, preference being given to those who can read and write. It is necessary before a man can obtain a license to practise vaccination (which has to be signed by the Civil Surgeon and countersigned by the Magistrate of the district) that he shall have undergone systematic training in vaccination for at least three months under the instruction of the Civil Surgeon, or an Assistant Surgeon, or a Civil Hospital Assistant, or an Inspector or Sub-Inspector of Vaccination, and the Civil Surgeon is expected to satisfy himself by personal examination that the candidate understands all the details of true vaccination, and is in other respects qualified for the appointment he seeks. Licensed vaccinators are not, strictly speaking, Government servants, but they are allowed certain privileges which the latter enjoy, and the grant of a license to practise vaccination entails on them the duty of submitting to the supervision of the Government Inspectors, furnishing the returns prescribed by Government, and depositing a security of Rs. 10 in the nearest Post Office Savings Bank as a guarantee of their good behaviour, and also in order to secure Government against loss on account of the Government property in their possession, such as lancets, stationery, forms, &c., with which they are provided free of cost. Each licensed vaccinator is assigned a definite area of country which he is expected to maintain properly vaccinated ; the area allotted to each vaccinator covers an average of about sixty square miles and contains a population of about 24,000 inhabitants.

5. As a rule these vaccinators work in a satisfactory manner ; their homes are usually situated somewhere within their beats ; they are an intelligent body of men, and are well acquainted with the usages and prejudices of the people among whom they work. It is to their interest to perform vaccination operations carefully and with good lymph, as they are paid by the people only for each successful case.

6. When a serious outbreak of small-pox occurs, which is but seldom, vaccinators paid by Government at the rate of four annas a day each are specially appointed by the Civil Surgeon to stamp it out.

7. The lymph used in Bengal is obtained from two sources—*first* from children, and *secondly* from calves ; the latter is raised in two animal vaccination depôts (one of which is at Darjeeling and the other at Calcutta), which are specially kept up by Government for this purpose. Lymph from these depôts is distributed monthly to all the districts in proportion to their population, and is intended principally to start vaccination in remote places. A stock of lymph is also kept up at both the depôts in order to meet emergencies, such as sudden outbreaks of small-pox. Calf lymph is also raised locally in selected areas of districts where the work can be immediately supervised by the Civil Surgeon or other Medical Officer, such as an Assistant Surgeon. This locally raised lymph is employed in vaccinating large communities at the head-quarters of districts, such as prisoners in jails, inmates of lunatic asylums, and persons working in factories.

8. As a rule the people of Bengal accept both human and calf raised lymph without objection. There are, however, some who object to calf lymph, as there are others who object to human lymph. I will give an example of a case that occurred lately in a prejudiced Hindu community. Dr. Banks, the civil medical officer who reported the occurrence, says :—

> " I am very much afraid the arm-to-arm system must be chiefly adopted judging from what happened yesterday. All the vaccinators were assembled to be taught calf vaccination, and no sooner was the calf placed on the table, then, with the exception of a few native Christians, they all bolted in holy horror. The calf was shaved and vaccinated in five points only, which I considered sufficient under the circumstances. The antipathy to calf vaccination by the jail and hospital officers is obvious, and the fact is I have practically to do everything myself. Neither the Inspector nor the Sub-Inspector shows any enthusiasm over calf vaccination, and are absurdly ignorant as to how the operation is performed. When the municipal vaccinator is called upon to operate he does so reluctantly and with more feeling than he would bestow upon his nearest relative, and the result is that his incisions are mere apologies and his operations unsuccessful."

I will now give an example of another case that occurred in another district in which the population was largely Muhammadan. In this instance human raised lymph was strongly objected to. The Civil Surgeon reports :—

> " Ferazee Musalmans object to arm-to-arm vaccination ; they prefer vaccination by lanoline vaccine paste. I find this is invariably the case in districts where Muhammadans preponderate."

9. Taken all round the system of vaccination by licensed operators which is at present in force in Bengal is working fairly well, and when tested by results is satisfactory. The death-rate from small-pox in Bengal during the year ending 31st March 1894 was ·17 per mille, which may be accepted as approximately correct, as the registration of vital statistics in Bengal has lately much improved. In the remote parts of the province, such as Chittagong and portions of the Orissa and Chota Nagpur Divisions, which are bordered by wild and savage tribes, vaccination until lately was not much attended to, but attention having been drawn to this unsatisfactory state of things, improvement in these localities has now taken place.

LANOLINE VACCINE IN MYSORE.

BY P. PALPU, L.M.S.,

Assistant Surgeon, Bangalore.

INDIA may well be proud of the labours of Surgeon-Lieutenant-Col. King of Madras and Dr. Simpson of Calcutta. The former officer has the honour of being the first Indian experimenter that succeeded in variolating the calf and obtaining a safe vaccine therefrom, and thereby shewing that vaccinia is only a modified form of variola—a fact, however, that had already been experimentally proved by Dr. Simpson whilst residing in England. To Dr. King is also due the credit of the discovery of lanoline as a preservative of vaccine, especially suited for tropical climates. He began his experiments in 1890, when, on starting the manufacture and issue of his lanoline vaccine, it was noticed that the old stock of lymph with which the work was begun was not satisfactory. Several attempts were made to regenerate this lymph by passing it through the human being and the donkey ; but all failed to effect any appreciable improvement. He, therefore, set to work to start a fresh stock of lymph by repeating the experiments that Ceely, Badcock and others had made of variolating the bovine animal, and succeeded in the very first calf he inoculated. The vesicles produced had all the characteristics of good vaccine, and were much better than those produced by the old stock of lymph then in use. The latter lymph was, therefore, discarded, and the variola vaccine cultivated and kept up instead. This lymph, preserved in lanoline, was distributed to various parts of the Madras Presidency, and also to Burma and Ceylon, and over 400,000 persons vaccinated with the same with beneficial results. I had the privilege of working under Dr. King during the whole time he was conducting these experiments ; hence my acquaintance with the details of his investigations. On the abolition of the Department, I have had the opportunity of continuing the work on the same lines in the Mysore State.

The Mysore Government Vaccine Institute at Bangalore started work with the new stock of lymph above mentioned in March 1892, and continues its work of cultivation of vaccine and manufacture and distribution of lanoline paste to the present day. It is now four years since this stock of lymph was originally derived from small-pox, and throughout the period it has been kept up by *continuous calf-to-calf cultivation*, and there has arisen no necessity to attempt its regeneration by passing it through the human being or the donkey. Some time after its introduction into Mysore, it was again tried side by side with other stocks of lymph and was found preferable to these. The vesicles produced by the stock have throughout been good, and various medical officers that used the same have reported it as very satisfactory. The Sanitary Commissioner with the Government of Mysore states as follows in his report : " The vesicles produced in children in vaccination with lanoline vaccine have, in all cases, been good, and typical of good lymph."

The method of cultivation and preservation of vaccine followed is the same as was adopted by Dr. King.

Healthy calves, preferably female, of between one and two years of age—roughly judged by seeing that no tooth is shed—with soft white skin, are procured and kept " waiting " at the institute. A day previous to the operation, the calf to be inoculated is selected, and the portion of its body from the umbilicus to about half way between the teats or scrotum and the anus, including the inner and upper third of the thighs, is cleanly shaved. The next day, when the vesicles on the calf from which the lymph is to be transferred are ready, *i.e.*, when they are pretty full with clear, free and coagulable lymph, both the calves are laid on tables and secured by means of ropes.

In inoculating calves for the cultivation of vaccine only punctures are made, so that the irritation caused may be the least, and for paste the " line method is " adopted. It is advisable to have the punctures for cultivation in a calf different from the one in which lines are made ; but, from an economical point of view I was not able to spare separate calves for cultivation alone. The usual sites for punctures, when both punctures and lines are made on the same calf, are the perineum and around the teats or scrotum, and here they generally come up better than elsewhere. On the whole of the remaining shaved surface, except just at the folds of the thighs, lines are made from 1½ to 2 inches long, about an inch apart from each other. For making punctures, I use a German lancet, which serves admirably for the purpose, and they are inoculated with lymph carried on the point of the same instrument. The lines are made with an ordinary vaccination or bleeding lancet, and charged with lymph on a common flexible spatula. A special calf scarifier, designed by Dr. King for the purpose, combines the lancet and the spatula. The lines as well as the punctures are made as *superficial* as *possible*, and bleeding is avoided. This is essential, as otherwise the irritation caused by deep cut, and kept up by the presence of the scab which forms in that case, sets up inflammatory processes detrimental to the formation of healthy vesicles ; and if lymph from inflamed or aborted vesicles be put in, it is impossible to get characteristic pearly vesicles with clear coagulable lymph.

From the fourth day after inoculation the calf is examined both morning and evening, and when the puncture vesicles are full and their contents clear and free, the lymph is transferred to other calf or calves as above described ; and whether during the day or night, the moment the remaining vesicles have completely filled in, and, of course, before the lymph in them begins to turn turbid and the areola begins to form around, they are gathered for paste. This is done as follows : The vesicles are at first washed with soap (without any antiseptic) and plenty of sterilized water at about 100° F., and carefully and thoroughly cleaned, one by one, with a clean thin white towel soaked in water. They are then covered over with a similar wet towel to keep them soft ; and then, wiping a few dry with a clean dry towel, the operator stretches one of them well between the thumb and index finger of his left hand, and, while thus holding, gently removes the scab, if any, with a bleeding lancet, the point of which is broken off and made blunt, wiping the lancet dry on a towel kept for the purpose, and still maintaining the tension on the skin. He then scrapes the vesicle off clean in one gentle sweep of the instrument without drawing blood. The vesicles thus gathered are received in one of the glass pans of an ordinary apothecary's pair of scales, over which a second glass pan is retained to prevent the entrance of dust. After being weighed, the vesicle mass is transferred to a small agate mortar and thoroughly well pulped till the whole becomes a perfectly homogeneous mass. To this, anhydrous neutral lanoline is added and well mixed up. The proportion of lanoline usually added is 6 to 1 of vaccine pulp. The mixing should be so thorough as to ensure that every small particle taken out contains the same proportion of vaccine and lanoline.

The lanoline vaccine a thus manufactured is issued in glazed earthenware pots, or amber coloured glass tubes packed in cotton, in small light dealwood boxes, or bits of common reed or bamboo.

The calves from which the vesicles have been gathered—called the "done" calves—are kept for a week or two and then sold. The removal of the vesicles is advantageous to the animals, as it prevents or considerably minimises the secondary fever. The marks on the animals heal in about a week, and they go out in as sound health as they came in.

The average amount of lanoline vaccine got from a calf varied—a quantity sufficient for from 485 to 772 cases. The largest quantity obtained from a single calf was enough for 2,380 cases. Since the starting of the Mysore Institute, paste enough for 435,000 cases was manufactured and issued up to date (15th November 1894). Of this quantity, enough for 42,739 cases was purchased by medical officers in different parts of India and Burma.

Work of a more or less similar nature has been started in different parts of India, either with the help of persons trained at Madras or Bangalore, or under instructions furnished.

The price charged for vaccine paste sold to out-stations is 6 pies a case, and this covers the total cost, including pay of the establishment. Excluding the latter, the cost of vaccine paste is only 1·86 pies per case. It will be noticed that this is the lowest price for which vaccine could be got anywhere. In European countries the price of vaccine varies from 1 to 22 shillings, and in Madras vaccine lymph is sold at from 2 to 4 annas.

The steadily increasing appreciation of the preparation is due not only to the superiority of the lymph and its cheapness, but also due to the duration of its activity. The exceptionally long period the paste remains active, even when subjected to the exigencies of transport and climate, is the chief characteristic of the preparation. The duration of its activity may be counted in years, instead of in weeks or months, in specimens prepared with full care. Various reports have been received from medical officers that used the preparation, stating that it has given good results after one and two months, and under Dr. King, the paste was used with success on calves from one to six months after manufacture. Surgeon-Major Thomson, Deputy Sanitary Commissioner, North-West Provinces, when a member of the Leprosy Commission, took a specimen made on the 13th December 1890, which, after travelling through Madras, Burma, Bengal and North-West Provinces, gave successful result on the 11th June 1891, *i.e.*, six months after manufacture. Work in the Mysore Institute was started with paste over six months' old, and various specimens were tried there with success on calves from six to nine months after preparation. "Two specimens gave typical results nearly fifteen and seventeen months after manufacture. These had been sent from here to England, and thence to Burma and from there received back here, and were, therefore, not only old, but had been exposed to the influence of various climates. In these two specimens the earthenware jars in which the paste was stored having got broken during transmission, the samples were practically open all the time and therefore more liable to decomposition." In another instance paste, made on the 23rd July 1891, gave successful result on the 21st April 1894, *i e*, two years eight months and twenty-eight days after manufacture. In trying these old pastes, the instruments used were previously sterilized by passing over the flame of a spirit lamp, and other precautions taken to ensure freedom from contamination by vaccine from other sources.

From the time the institute was started, the arm-to-arm method of vaccination which was in force in the Mysore Province was entirely discontinued, and the lanoline-vaccine system adopted instead, and the result amply justifies the change. There has been, with increase of experience gained in the new method, a steady improvement both in the quantity and quality of work done. These will be seen from the following figures:—

PRIMARY VACCINATION.

Arm-to-arm method.

Years.	Total number vaccinated.	Percentage of success.*
1889-90 ...	72,587	83·63
1890 91 ...	68,732	83·83
†1891-92 ...	76,858	85·18
Average pecentage of success for five years ...		80·87

Lanoline-vaccine method.

Years.	Total number vaccinated.	Percentage of success.‡
1892-93 ...	85,283	93·02
1893-94 ...	94,156	95·19

* These percentages were calculated including the unknown cases in the total vaccinated.

† During the last quarter of this year the lanoline-vaccine system was in force, hence the increase in the number vaccinated and the percentage of success obtained.

‡ The above percentage have been arrived at by excluding the unknown cases from the total number vaccinated, as including them would mean that all cases returned as unknown were unsuccessful, which would be erroneous. Including the unknown cases in the total vaccinated as in the previous years, the percentage will stand thus:—

1892-93 ... 88 93 | 1893-94 ... 90·83

The results obtained with lanoline vaccine issued from Bangalore and used in other parts of India and Burma are also satisfactory. In 1892-93, out of a total of 6,042 cases vaccinated, 5,415 or 91·12 per cent. were successful, and in 1893-94, 7,186 cases were done with 6,709 or 94·73 per cent. success. The satisfactory results obtained outside afford further proof of the efficiency of the preservation, and suggest that if the procuring of sufficient numbers of calves could be managed, it would be even possible to work successfully a Central Imperial Vaccine Institute for all India and Burma, with a sufficiently large establishment.

Of all the methods of vaccination with animal lymph, the lanoline-vaccine system is the cheapest; and this is due to the average number of persons that could be vaccinated from a single calf under the system being the largest, the duration of its activity the longest, and the efficacy of the preparation, at least equal to, if not better than, any other. The following statement illustrates these facts clearly:—

Statement showing the average number of cases that could be vaccinated from a single calf under the various methods of vaccination with animal vaccine and the duration of activity of animal vaccine under the various forms.

	NUMBER OF CASES OPERATED ON WITH ANIMAL LYMPH.			TOTAL NUMBER OF CALVES USED.	AVERAGE NUMBER OF CASES YIELDED PER CALF CALCULATED ON		DURATION OF ACTIVITY.	REMARKS.
	Direct from the calf.	Preserved lymph.	Total.		The cases direct from calf.	Total number of cases with animal lymph.		
	Calf lymph unmixed with any preservative.							
Kurnool District, 1890-91	32,259	609	32,868	439	73	75	12 to 120 hours.	*Vide* Vaccination Report, Madras, for 1890-91, pages 16 and 17.
Madras Municipal City, 1890-91 (up to 31st January 1891).	19,663	12,318	31,981	506	39	63		*Vide* Vaccination Report, Madras, for 1889-90, page 24.
Madras Presidency, 1889-90	100,000	1,153	101,153	1,689	..	60		
Madras Presidency, 1890-91	142,672	25,022	167,694	2,506	57	67		*Vide* Vaccination Report, Madras, for 1890-91, pages 16 and 17.
	Calf lymph preserved in glycerine.							
Madras Municipal City	Glycerized vaccine average per calf		..	..	..	160	15 days.	
	Ditto highest quantity from a single calf			..	..	400		
	Calf lymph preserved in lanoline.							
Madras Presidency	Bangalore ..	...	.. average	..	..	560	From a few weeks to 2 years, 8 months and 28 days and perhaps still longer.	
	Trichinopoly ..	..	.. do.	..	..	772		
	Madras ..	..	.. do.	..	..	689		
Mysore Province	Bangalore ..	...	.. do.	..	..	*488		* The decrease is due to cultivating vaccine in the same calf that is vaccinated for paste.
				Highest per calf	.. 1,660	to 2,380		

From the above statement it will be seen that the fresh lymph system is the most difficult and costly; the glycerised vaccine system comes next; but glycerine has various disadvantages, and has been found unsuitable to India. The Sanitary Commissioner, Bengal, gives the following reasons against the glycerised vaccine :—

> "(1) The inherent objections to a fluid medicine when the compound is, as in this case, not a solution, but a mechanical mixture—the denser particles sink to the bottom, and the different strata are of different composition and concentration.
>
> "(2) Glycerine is a nutritive medium for the growth of putrefactive and other germs, and, being fluid, the germs soon pervade it throughout; and, as a fact, this preparation in India soon becomes putrid and septically dangerous.
>
> "(3) The preparation loses its activity very much sooner than does lanoline paste.
>
> "(4) The preparation is, in appearance, so repulsively like ichorous purulent 'matter,' that this of itself is one of the strongest objections to its use.
>
> "The preparation of glycerised lymph has, for the above reasons, been entirely discontinued in both the Calcutta and Darjeeling Depôts. Lanoline, on the other hand, has proved to be very successful and is undoubtedly the one mode which is pre-eminently indicated as a preservative and diluent of lymph for India. It has all the advantages of a solid excipient, the non-possession of which, as above, renders glycerine so objectionable. Lanoline is a medium unfavourable to the growth of germs, and any extraneous germs, putrefactive or other, alighting on the lanoline preparation, do not tend to penetrate within. The preparation in appearance is not at all offensive, and its certainty of action and great keeping-powers, when properly prepared according to Dr. King's instructions, are beyond question."

SOME NOTES ON VACCINATION WITH SPECIAL REFERENCE TO AN EXPERIMENTAL FREE SCHEME IN THE DISTRICT OF PURI.

BY O. BANKS,
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It has been abundantly demonstrated, and the fact is patent to every intelligent mind, that vaccination, when successfully performed, does confer entire immunity to small-pox in many instances, for long periods in others, and at least justifies all that is claimed for it. The great majority of educated Hindus are fully aware of these facts; but the experience of the greater part of a century has not prevailed upon many of them to give up their *so-called* religious prejudices and accept vaccination gracefully. Attempts were made to introduce vaccination into Bengal early in the present century, but until thirty years ago met with practically no success. Inoculation, on the other hand, was practised everywhere and held in great repute, chiefly owing to the influence of the *Thebaits*, or hereditary inoculators, and at the present time you will rarely meet with a native over thirty years of age who does not possess the inoculation mark on his forearm. A very fair idea of the extent to which the practice prevailed can be derived from the admissions into jails. In 1893—88 male and 3 female prisoners who had been vaccinated, 502 male and 16 female prisoners who had been inoculated, 361 male and 10 female prisoners who had had small-pox, and 32 males and 2 females who were unprotected, were admitted into Puri Jail. Out of 973 admissions, 518 had been inoculated and 361 had had small-pox, that is to say, 90·3 per cent. of all the prisoners admitted had either been inoculated or had suffered from small-pox. The villages in the district tell the same tale, and while the rarest object to be seen in an English village nowadays is a pock-marked face, nothing is so common in an Indian one. This may be regarded as one of the strongest arguments in favour of vaccination. Wherever vaccination and re-vaccination have been carried on energetically under compulsory measures, with heavy penalties in cases of default, small-pox has been stamped out, almost completely. Between 1870 and 1873, when the great visitation of small-pox swept round the world, 20,575 deaths are reported to have occurred in Germany, whereas in 1890, under compulsory enactments, only one death was reported. Complaints came from every district in Bengal about the havoc caused by the practice of inoculation, and terrible epidemics of small-pox could often be traced directly to the arrival of the inoculators. The difficulty (as to how the evil was to be overcome and the disease got rid of, or its ravages mitigated) *confronted Government*, and every thing possible under the circumstance was done to try and induce the people to give up inoculation *without* actually resorting to compulsory measures. The *Thebaits* were prevailed upon in some instances to take to vaccination, but it was soon found out that they vaccinated the children of low caste and inoculated those of high caste. In Burdwan an attempt was made by an assistant surgeon to break down the prejudices of the people by carrying on a system of mock *poojahs*. Circulars were issued in other instances pointing out the benefits to be derived from vaccination and offering it free of charge to all who would accept it, with the result that in one year in a certain district the handsome number of 14 operations were performed, of which 7 were successful, 5 unsuccessful, and 2 doubtful. In Soory, Beerbhum, from 1837 to 1868, 24,361 operations were performed, of which 12,361 were successful. The average number of operations performed yearly during this period was 761, of which 385 were successful. The annual proportion of the vaccinated to the total population was 0·050 per 1,000, of which 0·025 were successful. In Bhagalpur, in five years, 1,519 operations were performed chiefly, amongst Europeans, Eurasians, Native Christians and educated and intelligent Bengalies. In Maldah, in 1867, 25 operations were performed, of which 20 were successful.

In no part of Bengal was the task found so hopeless as in Midnapore, Balasore, Cuttack, and Puri. In these districts very little progress has been made, compared with other districts, and the results are seen in the comparatively high death rate from small-pox. So strongly were the inhabitants of Puri town in favour of inoculation that, when the Compulsory Vaccination Act was introduced in 1881, many of the parents crossed municipal limits to place their children in the hands of the inoculators. Inoculation was clandestinely practised in the district until two years ago. It is on record that in 1866, in the district and town of Puri, *from July to December*, 11,350 cases of small-pox were reported by the police with 3,627 deaths, in great part due to this evil practice. Despite stern resistance and threats, a fair amount of progress has been made ; but vaccination has a long way to travel in Bengal, and still further in backward Orissa, before the results can be regarded as any thing like satisfactory. It must be remembered, however, that Bengal Proper has had the advantage of British influence for nearly half a century longer than Orissa, and that the influence of local priests and high caste Brahmins in Puri and its neighbourhood is very powerful, and seriously handicaps the progress of hygiene in every department.

The payment of a fee of two annas per head by the parents was considered one of the chief defects of the reorganized scheme and the cause of the opposition to vaccination in Puri district. In order to prove, if possible, whether such were the case, Dr. Dyson, lately officiating Sanitary Commissioner for Bengal, prevailed upon the District Board of Puri to set apart the sum of Rs. 850 towards an experimental free scheme. This scheme was introduced on 24th December 1893. The vaccinators received one anna per successful operation up to one hundred and one half anna for every successful operation monthly over that number. Weekly progress statements were submitted to the various civil hospital assistants in the district, who, after making as much enquiry as possible, submitted them, with any remarks they thought necessary to add, to head-quarters. Separate certificates were submitted at the end of the month by the inspectors, sub-inspectors and vaccinators, stating, respectively, the number of successful operations performed and inspected and the names of the villages in which the work was done. These certificates showed the movements of the inspecting staff, allowed of the figures being checked in any selected area, and exercised a wholesome influence over the minds of the whole vaccination staff. When the figures gave rise to suspicion, the salary of the vaccinator concerned was withheld, pending enquiry, and in only two instances had vaccinators to be ignominiously dismissed for sending in spurious returns. This may be regarded as satisfactory in view of the fact that the scheme was in its infancy. On one point at least I am satisfied, *viz.*, *that value was obtained for the money spent.* From the beginning of the working season (1st October) till 24th December 1893, 4,189 operations were performed, and from the latter date till to the end of the season (31st March 1894), 12,639 operations were performed, or three times as many operations were performed during the latter half under the free scheme as during the former half under the reorganized scheme. The marked difference in the results under the two schemes was solely due to the fact that experienced vaccinators were not forthcoming to work under the two-annas-per-child system, and it was only when the free scheme was announced that the services of intelligent and respectable men were secured. The work was subjected to very careful inspection by the Magistrate, Sub-divisional Officer, Civil Hospital Assistants and myself as superintendent, and it was well nigh impossible for the vaccinators to fabricate their reports. I can confidently assert that no operations in the absence of lymph were performed with either milk or water, as I have reason for believing was sometimes done under the reorganized system when the vaccinators were entitled to two annas per operation, successful or otherwise. No conclusions can be drawn so early in the history of the scheme as to its effect on the mortality from small-pox, but it is satisfactory to note that the number of deaths during the first ten months of the present year has been only 385 against 2,415 of the past year. The experiment is being continued during the present year, and although the vaccinators were offered better terms, or at the rate of one anna per successful operation, up to 128, several of them refused to accept the conditions, declaring they could not possibly make a decent livelihood, and insisting upon 1½ annas per operation or Rs. 8 per mensem without any restriction as to numbers. To have submitted to their terms would have put a premium on laziness, and with the sum of Rs. 800 granted by the District Board on this occasion, only 8,000 operations could have been paid for, and thus the experiment, whose object is to secure the largest possible outturn of work at the lowest possible cost, would have been a complete failure. I had no other alternative than to take back their instruments and cancel their licenses. Native parents resent the slightest injury to their children, and are terrified lest they should contract some deadly disease, as the results of an operation which they hold in suspicion, because they have not been accustomed to it. The same feeling is witnessed in England, where I am fully convinced very many children would remain unprotected but for the fact that parents are *obliged to have their children vaccinated.* In view of the risk an unprotected child runs of contracting a fatal attack of small-pox, and the danger to the community at large, the trifling amount of discomfort arising from vaccinatiom cannot be regarded as sufficient reason why the operation should be withheld on compulsory measures enacted to enforce it. Nearly thirty years ago a civil surgeon wrote : "I have illustrated my opinion before by speculating what success a foreign conqueror would have had in England if he had signalised his conquest of the country by an edict that every male child should be circumcised, instead of baptised, and yet our Government in India acts still more wildly. It passes no law, issues no command, uses none of its own lawful authority, but tells civil surgeons that they are to be held responsible for the diffusion of vaccination through their districts." He goes on to remark that vaccination will not succeed for two principal reasons, *viz.* :—

1. The people will not accept it.
2. The Civil Surgeon has no power to make them accept it.

That is just exactly the position we are in at the present time. Every scheme hitherto devised to further the interests of vaccination has been to a greater or less degree a failure, or at least has not met with the success anticipated. *Make vaccination free* (at least) *to the poor* and *compulsory to all? Allow even ¾ths of an anna* for every successful operation which would be ample remuneration under the more favourable conditions, and the cost to the District Board for vaccinating 28,000 children yearly would be something like Rs. 1,312. Accumulated arrears would have to be overtaken during the first year or so, the cost of which would not be great, and perhaps might be met out of the savings effected on the sum set apart for the 28,000 children, many of whom, owing to their extreme youth and other causes, are unfit for vaccination. Under the present free scheme, *without compulsion*, I would not like to undertake to have 28,000 children successfully vaccinated for less, but *with compulsion* I believe it possible to reduce the allowance per successful operation, and still retain a good and trustworthy vaccinating staff. To this amount add what is already spent out of Provincial Funds, or Rs. 1,503-4-1, towards pay and travelling allowance of the inspectors and sub-inspectors and contingencies, and the total expenditure would be Rs. 2,812 :—

District Board	...	... Rs. 1,312
Provincial Funds	...	... „ 1,500
	Total	... Rs. 2,812

or 1 anna 7 pies per successful operation, which is very moderate indeed, when we take into consideration the fact that that was exactly the average cost of each successful operation in the Districts of Bengal during 1893-94 under the *reorganized scheme* under which parents *are supposed* to pay the fees. If such a scheme, combining compulsion with free vaccination, is ever introduced, I would suggest that, towards the end of the working season, every parent or guardian who did not submit his children to the operation when he had the opportunity for doing so, should be made to pay for it at the end of the season, and in default that the case be referred to the District Magistrate. With such a large army of chaukidars intimately acquainted with the people, there could be no difficulty in bringing defaulters to book, and by delegating to the Civil Surgeon, as Superintendent of Vaccination, powers to deal with such defaulters, would save the District Magistrate and other judicial officers a vast amount of time and trouble.

VACCINATION SYSTEMS IN INDIA.

BY S. KANTAK,
Bombay.

VACCINATION was introduced into this country *via* Bombay as far back as May 1802. The circumstances connected therewith are matters of history. How, for instance, Jenner failed to induce the Government to carry out his proposal of sending lymph by means of a series of vaccinations, and how Dr. De Careo, of Vienna, then sent charpie, soaked in lymph, by land through Turkey. But the earliest record available in Bombay dates only from the year 1848, the number of operations being only 5,266.

The technical aspect.—This involves the consideration of—(*a*) the lymph in use; (*b*) the methods of operation; and (*c*) the results.

(*a*) *Lymph.*—Concerned as we are with the existing modes of carrying on vaccination in this country, no object can be served in discussing the more abstruse questions. The bulk of vaccination in this country is carried on with humanized lymph, and extended direct from arm to arm, or by lymph in capillary tubes, or even by softened scabs. Although the administration reports, one and all, contain expressions of hope that animal vaccination might be adopted to the exclusion of humanized lymph, it is only in Berar and Assam that it has entirely replaced the arm-to-arm system. How much of this state of things is due to unavoidable causes, it is of course impossible to say; but some high sanitary officers consider that "vaccination by fresh lymph from arm-to-arm is the safest and best system of operation and affords the maximum protection against small-pox;" while others are opposed to animal vaccination, on the principle that the "cultivation of calf lymph should be encouraged only at certain centres, where strict veterinary precautions can be rigorously carried out." But the animal lymph used in the various provinces differs as much in its character as in the mode of its cultivation. Thus, for instance, the lymph used in the Punjab is entirely cultivated in the buffalo; the same animal is very often used in the Central Provinces and Berar; but elsewhere the vaccine comes from the cow-calf. Again, the animal lymph used in the Punjab and Berar is fresh, the vaccination in the villages being done from calf to arm; while in Assam it is exclusively "preserved;" and in the Madras Presidency both the fresh and preserved kinds are used.

We know that Dr. King advocates lanoline, while Dr. Dobson, in one of his reports on the Shillong Depôt, brings forward the following points in favour of "glycerine lymph:"—(1) It keeps much longer than the lanoline paste; (2) the scarification on the child's arm does not require to be so deep, as "glycerine lymph" is more fluid, soaks in better, and is more readily absorbed; and (3) the lymph does not require to be rubbed in so forcibly. Against this opinion of an officer, who speaks from a large experience acquired at a depôt, which supplies annually nearly 240,000 tubes for the entire vaccination of a province, and endorsed also in unmistakeable terms by another at the Madras Depôt we learn that in Bengal the "glycerized lymph" is condemned on account of—(*a*) the rapid loss of its activity; (*b*) its "ichorous" look; (*c*) its being a fluid medium, wanting in homogeneity and uniformity of strength and concentration; and (*d*) the belief that glycerine is a nutritive medium for the growth of putrefactive and other pathogenic germs, rendering the preparation septically dangerous. The majority of the sanitary authorities, however, appreciate the value of lanoline paste, which undoubtedly keeps active for some weeks.

But whatever may be the difficulties in the way of the spread of animal vaccination from the economic point of view, it would appear that the Indian public generally do not regard it with disfavour. Judging from Bombay experience, the great drawbacks of animal vaccination are its expensiveness and waste of material. In Bombay, where it has been exclusively carried on under Compulsory Act for the last seventeen years, the average cost for the last triennial period, per successful case, was Rs. 0-14-9, and yet the net cost of each animal was not more than Rs. 3. The poor condition of cattle generally makes it necessary to keep a large live-stock in hand with all its attendant expenses; and casualties swell the outlay. In connection with the univeral use of preserved lymph, which its advocates urge upon the Government, it must not be forgotten that the vaccinator's duties will be made so easy and simple; he will lose what little knowledge he now possesses as to the selection of lymph. The encouragement given to the extension of animal vaccination, and the progress which it has been making hitherto, gives us hope that before long it will be the only system in universal practice in this country.

As already stated, the method of cultivation resorted to in most of the depôts is retrovaccination, complete as in the Central Provinces, Berar, and Assam, and partial as in Bengal, Burma, and the Punjab. It is, however, to be regretted that the description given is generally too meagre to enable one to do more than conjecture the precise methods adopted. Thus we find that at the Darjeeling Depôt, in Bengal, the inoculation of calves is done by a modification of the German and Brussels systems, and runs a retarded course, and is often followed by the development of secondary vesicles. Lymph used to be preserved in four forms, *viz* :—(1) simple lymph sealed in capillary tubes, (2) simple lymph stored in capillary tubes but sealed at either end in glycerine, (3) glycerized pulp, and (4) lanolized pulp. The first two kinds, which keep active only for one or two days, as well as the third, have been discontinued ; and lanoline paste alone is now manufactured and distributed. At the Shillong Depôt, in Assam, humanized lymph is used every two days in calf inoculation. The solid vesicles *without the serum*, which is believed to act injuriously on the stuff, are thoroughly pounded with a mixture containing two parts of glycerine to one of distilled water, and stored in capillary tubes, and hermetically sealed. The storing is a very tedious process. I have used the preparation on two or three occasions, but without much success. In Burma, at the largest depôt, which is looked after by the Health Officer at Rangoon, inoculation is done by means of bovine scabs and humanized lymph, the scabs being dissolved in a mixture of glycerine and distilled water. At Pachmari, the principal depôt in the Central Provinces, the necessity for keeping a cattle farm is not felt, nor even one for the purchase of calves. Calf-to-calf inoculation is not carried beyond the fifth generation, humanized lymph being used to renew the stock. Lanoline paste is prepared in the proportion of one to five parts. But besides the depôt, a general system of animal vaccination has been introduced into the villages, the inoculation of the village calf being done sparsely and by valvular punctures only, in order to avoid alarming the owner thereof, and left with him until the vaccinia develops, when the vaccinator comes and operates on the village children, and inoculates calves belonging to the neighbouring villages. In Berar, as in the Central Provinces, the system of calf inoculation is pursued after the German method, except that humanized lymph appears to be entirely used after the fifth generation. Lanoline paste is prepared after Dr. King's directions. But calf-to-arm vaccination is preferred as being less expensive. In Bombay, the principal depôt is worked on the animal vaccination system, a large stock of calves (cow) being kept on hand, so that, before inoculation, a calf remains under observation for not less than a fortnight. Pure calf-lymph is alone used for inoculation, and preserved in capillary tubes, sealed at either end, in glycerine. Inoculation is done after Warlomont's method. The stock is renewed by half-yearly supplies of bovine lymph from the National Vaccine Institute. At all the city stations vaccination is done direct from the calf, and preserved lymph is sent out on requisition.

A noteworthy feature of the majority of the systems of animal vaccination detailed above is the attempt at simplifying the whole procedure; in fact, as with the arm-to-arm system, so with this, the general desire seems to be to show that the technique can be reduced to such simple proportions that it may be easily worked out with success by any ordinary vaccinator; and in spite of the cautious expressions of opinion by some sanitary authorities, the advocates of the system have very nearly succeeded in their desire, but by varied means.

And what are the qualifications of men who are to be entrusted with these operations ? The answer is self-evident. In the Bombay Depôt about 700 calves are used annually, and they are carefully examined by veterinary inspectors before admission. Figures extending over only three years show that, during this period, 397 calves had to be rejected on account of cattle disease, 143 being "inoculated" ones, and 254 otherwise. To what extent vaccination work, which goes on throughout the year, must have been hampered can be better imagined than described.

Anyhow it may be assumed that the Western Presidency is not singular in the condition of its cattle; but what is singular and significant is, that in provinces where calf-to-arm vaccination is carried on in villages, nothing is said as to the necessity for the careful examination of the calves *before inoculation* and before *taking lymph* from them.

The methods of operation.—As the object of the vaccinator is to raise a vesicle at the site of every insertion, and at the same time not to frighten the guardians of the child operated upon, much ingenuity has often been exercised in devising instruments calculated to serve this purpose. But the development of a vesicle depends as much, or even more, on the quality of the virus than upon the nature of the instrument, and less upon the latter than upon the skill of the operator. In spite of variously constructed instruments, the old fashioned bleeding-lancet still holds the field, and the method of operation generally is by a single valvular puncture, three being done on each arm. Extended observations and experience have, however, shown the desirability of producing a larger vesicular area than is possible with the single puncture. Accordingly, since the last few years, primary vaccination, except under very unusual circumstances, is being performed in the Western Presidency by "multiple" punctures—a central valvular puncture with smaller punctures all round. It is, however, obvious that with preserved lymph, of whatever consistency, the puncture method of operation does not yield satisfactory results. Buist says that "the storage of lymph in any way whatever, and even for the shortest period, exerts an injurious influence upon its activity, rendering a more severe operation necessary to ensure the desired success."

Resulting success.—The following table gives the percentages of success in both kinds of operations in the different provinces, the figures being generally averages of the last five years:—

	Bengal.	N.-W. Provinces.	Punjab.	Central Provinces.	Berar.	Lower Burma.	Upper Burma.	Assam.	Madras.	Bombay.
Primary vaccination.	99·43	92·61	95·24	96·34	95·4	85·89	84·46*	91·26†	94·9	94·97
Re-vaccination.	40·83	57·61*	54·06	80·33	29·8	58·19	74·44	82·90	76·8	61·29

* Average of 4 years—1889-90 to 1892-93.
† Do. 1890-91 to 1893-94.

From these it will be observed that the success rate in primary operation varies from 84·46 to 99·43 per cent., and in re-vaccination from 29·8 to 82·90 per cent. The best result in primary vaccination is seen in Bengal, and the lowest in Upper Burma. In according Bengal the first place, it must, however, be noted that the ratio is calculated *after* excluding the "unknown" cases—a process which would naturally raise the percentage. The partial, or complete, failure of a vaccination depends on several causes, and nothing brings the operation into so much disrepute as failure; for, with ordinary care, we are told by authorities like Marson, Sheppard, and others that there should not be more than one failure in 150 operations. Marson himself vaccinated on 1,000 cases with only a single failure, and Sheppard without even one in 2,000 cases. As far as arm-to-arm vaccination is concerned, failure is indicative of carelessness on the part of the vaccinator, selection of lymph, and attention to the health of the child to be operated upon being the most important part of his duty.

We know that an operation may be successful in the sense that it has not entirely failed; but whether the full expression of the desired effect has been secured can only be judged by noting the development at the site of each insertion. It is, therefore, as necessary to know this as the "general" percentage of success. Vaccinators in this country cannot be too well impressed with the importance of securing a complete insertional success, although it is now recognized in Germany that even a single good vesicle gives protection for a time; for the condition of that country with its compulsory re-vaccination is widely different from that of India. The report of the National Vaccine Institute in London for 1887-88 gives the rate at 96·3. In the Presidency Circle at Bombay we find the percentage of insertional success to be only 77·95 in 1893-94 as against 80·11 in the preceding year. This is due to variations in the quality of lymph consequent upon cattle disease. Some remarkable experiments made in Dacca Jail in 1892 sufficiently illustrate the oft-recurring susceptibility of the human system to vaccinia, not only when it has been recently protected by an efficient vaccination, but even by an attack of small-pox. It appears that 3,465 prisoners were successfully vaccinated, of whom 1,667 had been protected by variolous inoculation, 197 had had small-pox, 1,445 had been previously vaccinated with success, and 156 were unprotected. At first 2,719 were successful, of these 2,032 were once more operated upon and 1,303 "took." Vaccination was also performed with success on fourteen prisoners one month after recovery from small-pox. These facts do not, of course, indicate the necessity for repeated re-vaccinations, which would be obviously impracticable; for susceptibility to vaccinia does not necessarily mean the existence of a susceptibility to variola. The popular idea, that a successful re-vaccination—successful in the sense that its development approaches very nearly the typical appearance of a primary operation—is indicative of the renewed susceptibility of the individual to an attack of small-pox, is based on a misconception of the relative capacity for reaction of the two viruses on the human system. As McVail has lately shown from Layet's tables given in the Bordeaux report and Dr. Barry's report, the resistance of the vaccinated to an attack of small-pox outlasts his resistance to re-vaccination.

Progress of vaccination.—In noting the results of vaccination in their bearing on the incidence of small-pox, it is desirable to observe (1) the proportion of infants protected to total births, and (2) the proportion of the vaccinated to the total living population. The figures in the following table show, side by side, the percentages of protected births, actual and estimated, in the different provinces:—

Percentage of children under 1 year unsuccessfully vaccinated to births in 1892-93.	Bengal.	N.-W. Provinces.	Punjab.	C. Provinces.	Berar.	Lower Burma.	Upper Burma.	Assam.	Madras.	Bombay.
	—		— *	—	—					—
Actual ..	12·5	24·99	80·0	78·89	84·11	23·66	...	26·89	31·1	80·12
Estimated ..	11·4	22·5	50·5	53·5	66·4	14·2	13 7	18·6	18·1	56·0

—Deducting deaths under one year. * For 1889-90.

Comment on these would be unnecessary when compared with corresponding figures in Great Britain: in England the average percentage of births "unaccounted for" from 1872 to 1890 was 7·8 in the metropolis, and 5·1 in the rest of England; and in Scotland it was only 2·1. The difference in the percentages marks the difference between birth registration as it is and as it ought to be. If vaccination is to do any good, it must protect the whole of the infantile population as it comes into existence, and this would be possible only if birth registration and vaccination were under one agency. It need hardly be pointed out, that if anybody is really interested in finding out births, it is the vaccinator.

It is curious that in only one province is the gradual reduction of small-pox fatality in proportion to the increase in the vaccinated community well demonstrated. A careful scrutiny of the statement does show that the averages for the quinquenniads are sometimes affected by the occurrence of epidemics.

Judging by the proportion of the vaccinated to the general population, it may at first sight appear that in some of the provinces where vaccination has been, comparatively speaking, lately introduced, it has made greater progress than in the older ones—Coorg, the Punjab, Central Provinces, and Berar being cited in illustration of the first; and Bombay, Madras, and Bengal as examples of the last. But such is really not the case, for the proportions are calculated on the sum total of the successful operations performed, which include re-vaccinations, and we know how re-vaccination has been pushed on in some of the provinces. Even the Western Presidency. . . . although the first in the Empire to obtain the benefits of vaccination, both human and bovine, has had to yield the palm to other provinces. But what is strange and disappointing is that the people during all these years should not have become fully alive to the palpable advantages of vaccination over the older system. We know that good and efficient vaccination affords sufficient protection to the individual, until its protective power has been dissipated by age, or by the intensity of epidemic influence. But what is the guarantee that the vaccination in all cases of so-called post-vaccinal small-pox has been what it ought to have been? We must not also forget that with the common people every thing which has developed at the site of the operation passes muster for vaccination, and it is easy to see that small-pox, subsequent to what is really no vaccination, should be put down to the inefficiency of the operation as a prophylactic.

Seasonal vaccination.—A noteworthy feature of the vaccination system is that, in almost all the provinces, except those of Bombay and Madras, the work of vaccination is seasonal. In some provinces the season commences in September and ends in March; in others it begins and ends a month later. I venture to think that in some districts of the Bombay and Madras Presidencies, the heat is almost as bad as any where else in the country, but the work is continued throughout the year; and experience has shown that with the exercise of the precautions, which are at all times necessary for the efficient performance of even such an insignificant operation as vaccination, the fears entertained about the deleterious influence of heat on the activity of lymph are exaggerated. An additional reason for pushing on the work during the hot season is the fact that small-pox generally breaks out, or, at any rate, rages with virulence at this time of year.

Vaccinating agency.—Most of the work is carried on by departmental vaccinators in all the provinces, except Bombay and Berar; vaccination is also done at medical institutions. Whatever else may be said about it, the retention of the entire control in the hands of a responsible department has the advantage of insuring uniformity in work and discipline. But we find that there is a growing desire to decentralize it, and, in some provinces, the immediate supervision over vaccinators and inspectors, and even their punishment, seems to have been left entirely to Municipal and Local Boards. Local self-Government may be ideally a very estimable institution, and no doubt it is when carried out on right principles. But those who have experience of vaccination work in municipal towns *know that the so-called enlightened citizens, who are, of course, generally on the Municipal Board, are the people who are reluctant to encourage vaccination in their families, except under pressing necessity.*

Besides the regular departmental hands, the work is carried on in some provinces by "licensed" and "private" vaccinators. In Bengal and Assam, the licensed, and, in Burma, private agency is employed. In Burma an attempt has lately been made to instruct the inoculators, "sayahs" as they are called, in vaccination, and engage them as departmental subordinates, or allow them to work privately. It is to be hoped that they do not practise their old calling under the garb of vaccination. Licensed and private agencies are, no doubt, cheap; but unless a very strict supervision of their work is assured, they are apt to prove too costly in the interests of vaccination. It would be too much to expect that private vaccinators, and, for that matter, even licensed vaccinators, would be amenable to strict departmental discipline. If difficulties are experienced in the execution of their duties by regular subordinates of the department, surrounded as they are with checks and safeguards from their superiors, would it be presumptuous to be sceptical about the ability of licensed and private vaccinators in this country to do the work satisfactorily? In his report for the year 1887-88 Dr. Cory says that in more than 38,000 primary operations performed by him, it only once fell to his lot to fail twice at an attempt at vaccination. I, therefore, venture to think that the time has not yet come when the Government agency could, with safety and propriety, part with any portion of its responsibility by licensing and otherwise allowing men other than departmental subordinates to do the work of vaccination.

Compulsory vaccination.—One of the most important features of the vaccination system from an administrative point of veiw is the difference which exists between one province and another in the application of the machinery of the law to compel the vaccination of children at an age when small-pox fatality is known to be exceedingly high.

The Western Presidency stands preeminently as the only province in which the Compulsory Vaccination Act is scarcely applied ; for, excepting the cities of Bombay and Karachi, the work in the whole province is done without any legislative support ; nevertheless it cannot be said to be one bit less efficiently or zealously done, as will be seen from the average work of the vaccinators and particularly the high proportion of births protected. The application of the Act, however, is necessary, not only to overcome the objections and prejudices of people in certain places, but it is equally necessary to stir up those, who, believing in the benefits of vaccination, are too blind to their genuine interests to take timely precautions against small-pox. Whether the neglect is due to one cause or the other, the result is the same, and those who plead for this "liberty of omissional infanticide," must be made to learn that they have no business to endanger the life of others by their apathy and indifference.

Female vaccinators.—It is noteworthy that mention is made of the employment of female vaccinators in only two provinces : in Bengal there was one Eurasian and in Madras there were 8 native. The necessity for the employment of female vaccinators is not very obvious, unless they are to be employed in the vaccination of *purdah* ladies ;—of course there is no reason why females should not be employed for the work. At London National Vaccine Institute, I believe, they have a female attendant whose duty is to prepare the children by the time the vaccinator comes round so as to facilitate work. It need hardly be said that the employment of trained women for such work in this country would be very advantageous ; for among the many causes which endanger the success of an operation, by far the most usual are the dirty condition of the children, and the extreme haste with which they are covered up with filthy rags and carried away, to say nothing of the anxiety to wipe off the wounds on the slightest appearance of blood as soon as the operation is finished.

Rewards for vaccination.—Lastly the system of giving rewards to vaccinators which prevails conspicuously in the Berar and North-West Provinces, deserves to be mentioned, if only to show what real interest the sanitary authorities there take in promoting vaccination. The pay of this really hard-worked class of public servants ranges from Rs. 8 to Rs. 24, inclusive of travelling allowance ; for, excepting municipal and cantonment vaccinators, every one has to travel from village to village ; the average area of each vaccinator's range is given only in one of the Madras reports and appears to be 349 square miles. The average strength of population looked after, as also the average number of persons vaccinated by each vaccinator in the different provinces, is, however, given in the following statement :—

	Bengal.	N.-W. Provinces.	Punjab.	Central Provinces.	Berar.	Lower Burma.	Upper Burma.	Assam.	Madras.	Bombay.	Calcutta City.	Madras City.	Bombay City.
Average population per vaccinator ...	25,528	57,216	67,834	48,762	65,842	71,671	104,724	26,074	43,483	49,536	19,581	18,855	102,720
Average No. of persons vaccinated by each ...	632	1,349	2,747	1,740	3,316	2,402	2,363	927	1,367	1,794	406	1,036	2,985

Although the average amount of work per vaccinator varies in the different provinces, still it is undeniable that, except in Bengal, the work turned out is fairly proportionate to their wages. At any rate, in view of the great importance of the work, the care and skill required to perform it, and the necessity for the constant exercise of a sufficient degree of vigilance to prevent evil consequences, it will be admitted that the labourer is worthy of better wages than he actually receives. *A better class of men might be induced to enter the department if the emoluments and prospects were alluring enough.* The pay of the upper subordinates varies from Rs. 15 upwards. How is it possible to get men, possessing a sufficient amount of technical education, to effectively check and supervise the work of the vaccinators on such low salaries ? A majority of these men are, perhaps, as uneducated as the men whose work they are called upon to inspect, as many of them have risen from the ranks. If financial considerations stand in the way of reform, there is at least one course open to the authorities, I mean the establishment of classes for the instruction of inspectors, vaccinators and apprentices. An experience of five years has shown me that this is of the utmost importance if the authorities desire to raise the standard of their work. Some practical instruction in the technique of animal vaccination seems to have been given in Bengal, Behar, Bombay, and Madras ; but I plead on behalf of the men who are called upon to do arm-to-arm vaccination, and here, if any where, a better knowledge of the subject than is at present possessed by this class of men is certainly requisite.

Financial.—A review of the vaccination systems would hardly be complete if no reference were made to the manner in which the department is supported in the different provinces. However much the provincial reports may vary in the supply of information and details of a technical character, there is a remarkable uniformity in their financial statements. There is much diversity in the sources from which the department is financed in the different provinces; thus: Provincial funds are the main stay of the department in all the provinces except Behar and Burma, where it is entirely maintained out of Imperial Funds ; but Bengal, North-West Provinces, and Bombay come in for a larger share than the others. Local funds are utilized to a much larger extent in Madras and Bombay than elsewhere ; and Municipal funds contribute towards the expenditure more liberally in these provinces than in Bengal and the North-West Provinces. In Bengal the Local fund contribution is nominal. The Native States of the Bombay Presidency appear to spend much more on vaccination than in any of the other provinces. The following figures show the cost per successful case in each province :—

	Bengal.		N.-W. Provinces.		Punjab.		C. Provinces.		Berar.		Lower Burma.		Upper Burma.		Assam.		Madras.		Bombay.		Coorg.	
	A	P.	A.	P.	A.	P.	A.	P	A.	P.	A.	P.	A.	A.	P.	A.	A.	P.	A.	P.	A.	P.
Cost per successful case	1	5	2	7	1	9	2	0	2	7	4	2	2	10	1	6⅓	3	8	5	8	3	10

The ideal sanitary department.—Since vaccination and sanitation have been linked together in this country under one direction, and it is through the vaccinating staff that the department may be said to keep in touch with the people, any measure of reform which is calculated to improve the tone of the former is likely to react beneficially on the work of sanitation generally. Nevertheless, it appears from several reports that, on the outbreak of cholera, or any other zymotic disease, the vaccination staff is detailed for duty in a medical capacity. It is obvious that their rank ignorance can hardly make them useful agents in the performance of the work. What possible good can accrue from his amateur medication ? It seems also that the supervising staff in some of the provinces are required to submit inspection reports on the sanitary condition of the smaller towns and villages.

At all events it will, I hope, be conceded that all these extra duties are so important that the employment of a better class of men for doing them would really result in much good. An ideal sanitary department should, I think, be composed of a more intelligent class of men as vaccinators, and the supervising agency of medical men varying in their qualifications according to their emoluments—those of the highest grade being University graduates—would fittingly constitute a connecting link between the commissioned administrative officers and the vaccinating staff. In their capacity as medical men their services could be further utilized by furnishing them with portable dispensaries. In spite of a goodly number of medical institutions, a considerable proportion of the village population knows very little of them.

It is these that will be reached by the supervising agency, who will be, as it were, the vanguard of the health missioners suggested by Miss Florence Nightingale.

DISCUSSION.

Cuffe (Allahabad) said he has some doubts as to the efficiency of the inspectors. Some time ago it was reported to him that a batch of coolies employed by the Military Works Department in a station in the North-Western Provinces were completely unprotected. He at once advised that contractors should be required to employ no other labourers than those vaccinated, when employed for works in connection with barracks and hospitals. He believed that orders of this kind, if generally enforced, would do much to assist the spread of vaccination and aid in making it popular.

Narendranath Gupta (Calcutta) said he has served for sixteen years as Deputy Sanitary Commissioner and agreed in all the views put forward by Dr. Gregg in the above paper, especially para. 5.

W. H. Gregg (Calcutta) said he had one observation to make on Dr. Palpu's paper, *viz.*, on Dr. Palpu's statement that lanoline, in the proportion of six parts to one part of lymph, was more successful than stronger mixtures. The experience of the Bengal depôts led him to believe that a larger proportion of lymph was necessary and more satisfactory.

Thornhill (Ceylon) stated that he was surprised to find that vaccination was not compulsory all over India. It is compulsory in Ceylon, under a penalty of Rs. 10. In Ceylon, too, he said that re-vaccination is compulsory on all who live in a house where a case of small-pox has occurred. In that island there was no real opposition to vaccination. He went on to say that small-pox has been virtually banished from Ceylon. When he arrived there twenty years ago yearly outbreaks used to occur, now a case of small-pox is looked upon as a *rara avis.*

Sundhori Mohun Dass (Calcutta) said that he believed steady efforts would overcome all difficulties of prejudice against vaccination. He showed how, by influencing the leading members in a Mahomedan village, he got the people to submit, and in one year the number of vaccinations more than doubled. He agreed as to the necessity of frequent and careful inspection, and spoke of the necessity for a staff of men to inspect the inspectors.

The President of the section said that the valuable papers read showed the unsatisfactory condition of public vaccination in India. In Great Britain the law demands that the vaccinator must be a fully qualified registered medical man, with a special certificate of having studied the subject, whereas in India the operation is entrusted to men of no education and little above the ordinary office peon in social status. In his own knowledge much of the objection to vaccination was due to the exaggerated, false and ignorant statements of vaccinators, and to the benefits to be derived from vaccination. They often inform the people that it will prevent fevers, measles, &c., as well as small-pox. Can it be wondered at then that distrust has arisen in the minds of the people? It is impossible that an operation, which, in civilised countries demands specially-trained medical men, can be successfully performed by men in this country of the lowest social grade! If the operation is to be performed upon human beings, it should be done with reasonable skill. Government should do its utmost to insist that the stock of vaccine be kept in a most efficient condition. The edict has gone forth for the use of "animal lymph." The result is that a system, in truth ill-fitted for use of human lymph, has been adopted for the use of animal lymph. If it is determined to use "animal lymph" in preference to human, the whole department must be reorganised *de novo.*

A single calf will supply lymph enough for 400 cases, but where are we to get 400 cases in a single place at the same time? At the same time, with animal calf lymph, fewer vaccinators will be necessary, and in this lies the possibility of enhancing their status and of getting a better class of men. Apart from being wasteful the system of from calf-to-arm had other objections.

The as yet undetermined microbe of vaccine is capable of degeneration, and its character may change, though it still produces vesiculation. Lymph may also acquire an inflammatory consistency, although conducted from calf-to-calf with careful selection of vesicles. Again serum from vesicles produced by the irritation of rough shaving may be mistaken by an untrained observer for vaccine. He had also seen lymph from an impetigenous eruption on the calf also produce magnificent false vesicles. Therefore he thought all would agree that the cultivation of animal lymph could not safely be left in the hands of untrained and illiterate vaccinators. The calf, from which lymph is to be raised, should be kept in perfect rest and quiet—how could this be attained by a vaccinator directed to perambulate from village to village? He had large experience of this method, and its results were always a supply of degenerate lymph bereft of all typical characteristics, though still capable of producing an irregular vesiculation that would satisfy the unwary. Therefore, both from a professional and economical point of view, could a "fresh lymph system" be solely adopted? The correct solution of the problem is obviously that adopted by the State of Mysore as detailed in the paper by Mr Palpu. In Mysore, in a special vaccine institute, under the best circumstances, is established—where lymph is cultivated and preserved ready for despatch to vaccinators, in any quantity that may be demanded. To trust to a supply of lymph produced by an unskilled man, as has been tried in some districts in Bengal, is to invite disappointment.

In short, special vaccine institutes should be established for every Government area, where lymph in sufficient quantity should be cultivated and prepared. The staff must be specially trained, and it should be a standing order that transmission of fresh lymph from calf-to-calf should not be permitted, thus, by constantly using the parent stock only maintained and kept up under correct conditions of cultivation in a specially fitted-up institute, it would be possible to ensure a reliable and uniform standard of efficiency throughout the country, whether vanoline or glycerine is used is a matter of any secondary consideration—*chacun a son gout.* As far as his own experience went, and that of Mr. Palpu in the paper just read, lanoline lymph is far cheaper, and, when properly prepared, more reliable as to duration of activity than its rival glycerised lymph.

SEWAGE FARMING IN BENGAL.

BY W. H. GREGG,

Brigade-Surgeon Lieut.-Colonel, I. M. S.

THE serious pollution of the rivers of Bengal, which are the main source of the drinking water-supply of the people, is a matter of grave anxiety, and requires the early and anxious attention of all who are concerned in the matter, in order that means may be adopted to prevent, as far as possible, injurious substances from passing into them. In a paper read before the Congress on "Unhealthy Tracts in Bengal," I think it has been conclusively shown that a supply of good drinking water to the people is the most essential requirement for their well-being. Attention has also been recently directed to the subject in connection with the selection of intakes for the water-supply schemes of some of the larger towns of Bengal which have been under the consideration of the local authorities. These rivers and streams are at present polluted, not only while they pass through the plains, but even close to their sources in the Himalayas and other mountains. This was prominently brought under my observation during a sanitary tour which I made in 1890 in the Jalpaiguri Duars and Darjeeling Terai, where I came across the following striking instances of the serious consequences of the pollution of the streams shortly after they issue from the mountains. It may here be mentioned that cholera is not indigenous to the soil of the Duars, but is caused principally by the consumption of water obtained from polluted sources, the pollution being imported in the persons of Chota Nagpur and Sonthal Parganas coolies. Of course there are other predisposing causes of the disease, such as the consumption of over-ripe fruit and decomposing food, which are frequently sold in some of the local bazaars, but the chief exciting cause in the Duars, as elsewhere, is undoubtedly polluted water.

2. The water-supply of the Duars and Terai tea gardens is obtained from rivers, streams, springs, and wells, and it is remarkable that wherever the source is specially protected from pollution, the inhabitants of the locality enjoy immunity from cholera. On the other hand, wherever it is unprotected and liable to pollution, there the disease always prevails with more or less severity according to the degree of pollution. There are numerous examples of this in the Duars and Terai, but it will be sufficient to give two or three only. Fig. 1 (*see page 258a*) is a rough sketch of two groups of cooly lines in one of the tea estates I inspected.

The water-supply of the group marked *A* is obtained from the river which flows past it. This river is polluted almost all the way from its source by the villagers who live on its banks, and there was a severe outbreak of cholera in *A* the year preceding my visit, *viz.*, in 1889. On the other hand, in the group marked *B*, which is alongside of *A*, but which obtains its water from a purer stream which has its source in a protected Government forest reserve, there was no cholera.

Fig. 2 (*see page 258a*) is a rough sketch of two groups of cooly lines in a tea estate in the Terai where cholera prevailed with great severity in 1889.

A drank the water of a notoriously polluted river, and cholera in *A* was very severe. *B* drank water of wells which were free from contamination, and although adjacent to *A*, escaped altogether from cholera.

FIG. 1

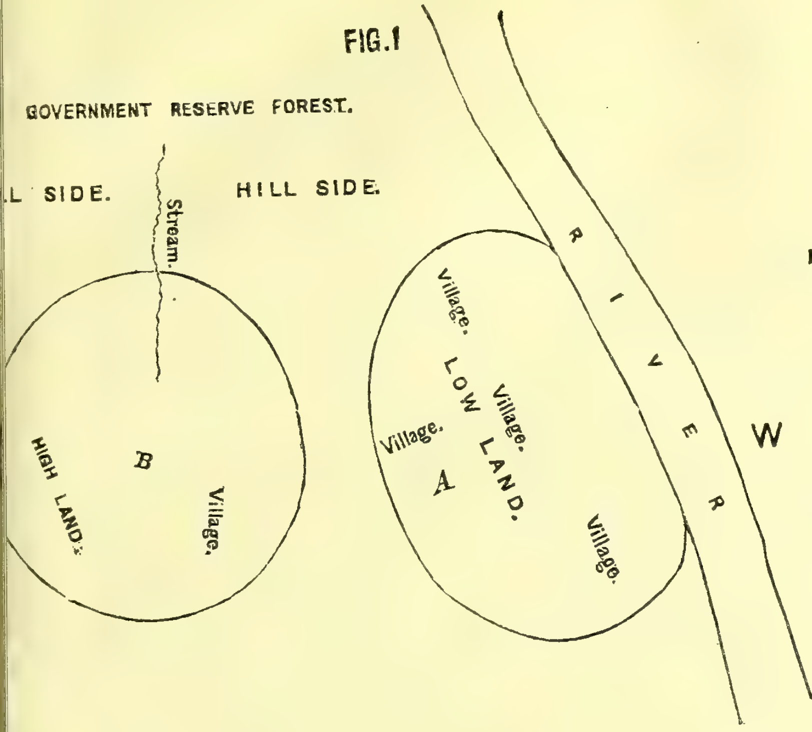


FIG. 3

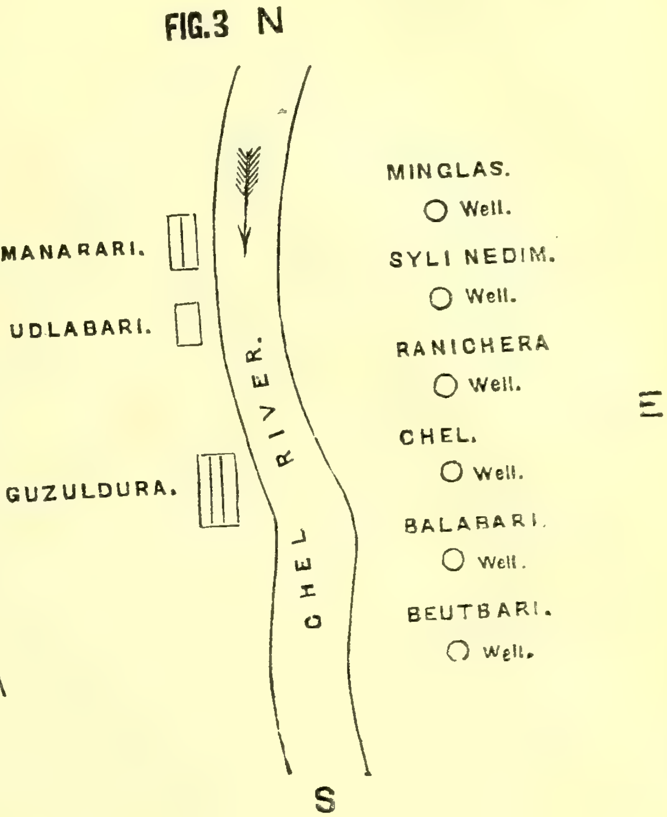
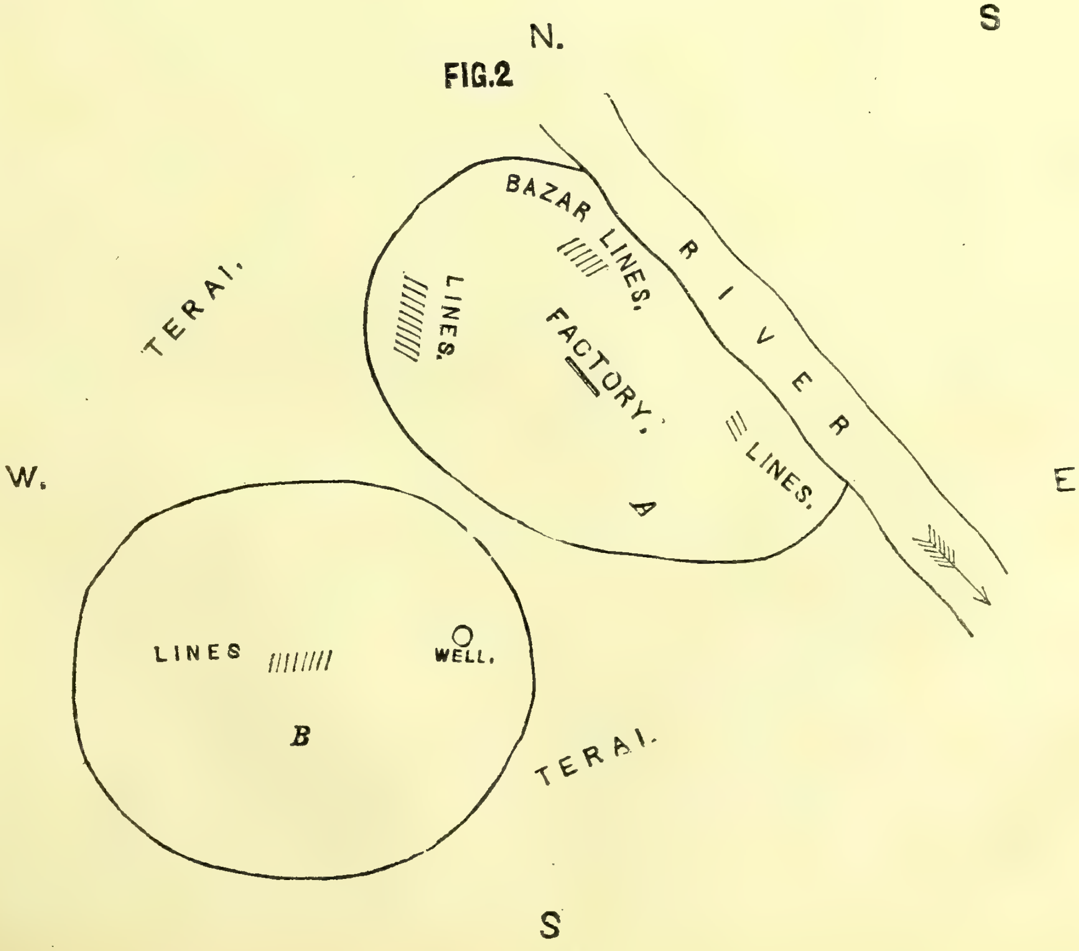


FIG. 2



The third remarkable instance of the susceptibility to cholera of persons who drink polluted water, and the immunity from the disease enjoyed by those who drink pure water, is illustrated in the case of the Chel river, a highly polluted stream in the Duars. In the year 1889 the inhabitants of the three villages shown in Fig. 3 (*see page 258a*) consumed the water of the river, and all of them were severely attacked with cholera in 1889, so severely indeed that nearly the entire population died of the disease.

There was no epidemic in any of the tea gardens on either side of the Chel river, not even in the vicinity of the affected villages; all these gardens drew their supply of drinking water from protected wells.

It would be difficult to find more striking examples than the three given above of polluted water being the principal cause of cholera; and as there is no doubt that most of the rivers which flow through Bengal are more or less polluted by the admixture of filthy and noxious matters, which find their way into the water from the numerous villages situated on their banks, the point to which I wish to direct attention in this connection is the proper disposal of sewage.

3. The success which has attended the introduction of sewage farming in Europe has naturally drawn attention to the subject in India, where the disposal of excreta and other objectionable matter of large towns is causing grave anxiety and is annually getting more and more complex. In the absence, in many places, of a proper means of disposal, dead bodies, carcasses, and especially human excrement, containing frequently the germs of serious diseases, find their way into the nearest rivers and streams, which, as already stated, are the main sources of the drinking water-supply of the people. In small towns, with populations under 30,000 inhabitants, the trenching system at present in vogue may continue to be carried out without much risk of polluting the water-supply; but in the case of large communities, such as towns with a population of over 30,000 inhabitants, this mode of disposal is unsatisfactory and open to serious objection. There are, however, the following difficulties in the way of introducing the system of sewage farming in Bengal:—

(*a*) The soil is, for the most part, alluvial, and so slightly raised above mean sea level that there is scarcely any fall.

(*b*) The surface of the soil is mostly level, and, unless specially prepared, is unsuitable for sewage irrigation.

(*c*) The amount of rainfall is excessive during certain periods of the year as shown in the following table which contains the average of the ten years, 1884 to 1893, of the twenty-five towns of Bengal, which have a population of over 30,000 inhabitants:—

NAME OF TOWN.	Population.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Calcutta	681,560	·59	1·30	1·58	1·26	6·50	12·11	12·32	11·66	10·70	4·58	·92	·11	63·63
Burdwan	34,477	·48	·93	1·82	1·15	7·37	8·90	12·66	9·92	9·18	2·39	1·07	·09	55·96
Midnapore	32,264	·41	1·39	1·63	1·18	6·07	8·94	12·63	13·77	8·26	3·23	·98	·12	58·61
Hooghly	33,060	·36	1·44	1·43	1·61	5·37	10·12	10·87	11·67	7·67	3·54	·94	·10	55·12
Serampore	35,952	·33	1·78	1·56	1·46	5·67	10·13	12·46	13·31	8·65	4·29	1·26	·19	61·09
Howrah	116,606	·43	1·12	1·44	1·03	5·86	11·79	10·77	11·75	8·43	3·79	·80	·09	57·30
Cossipore-Chitpur	31,423	—	—	—	—	—	—	—	—	—	—	—	—	—
Maniktola	32,865	—	—	—	—	—	—	—	—	—	—	—	—	—
South Suburban	69,642	·58	1·16	1·61	1·16	6·21	11·37	11·77	13·02	9·85	4·31	·89	·09	62·02
Barnagore	34,278	—	—	—	—	—	—	—	—	—	—	—	—	—
South Barrackpore (including Cantonment)	35,647	·37	1·75	1·42	1·44	5·43	9·69	11·67	13·00	8·46	4·12	·97	·13	58·45
Santipur	30,437	—	—	—	—	—	—	—	—	—	—	—	—	—
Murshidabad	35,576	·53	·99	1·44	1·63	5·84	9·16	11·17	11·09	9·57	3·23	·73	·07	55·45
Dacca	82,321	·52	1·54	3·04	5·11	9·77	13·58	12·57	11·38	7·04	3·73	1·53	·02	69·83
Patna	165,192	·78	·48	·46	·21	2·36	7·33	12·54	12·40	7·18	2·33	·11	·19	46·37
Bihar	47,723	·89	·66	·60	·22	2·37	6·13	12·52	12·77	7·17	1·56	·13	·16	45·18
Dinapore (including Cantonment).	44,419	·79	·38	·70	·08	2·20	7·04	13·56	14·11	7·39	2·90	·08	·19	49·42
Gaya	80,383	·73	·72	·65	·11	1·14	6·50	13·05	14·67	7·70	1·52	·21	·31	47·31
Arrah	46,905	·68	·52	·43	·04	2·29	5·64	13·76	11·92	7·64	1·90	·10	·29	46·25
Chapra	57,352	·87	·41	·55	·09	2·04	6·06	13·03	11·12	6·73	2·74	·23	·22	44·09
Muzaffarpur	49,192	·97	·36	·43	·34	2·36	8·31	13·10	10·59	7·69	2·64	·05	·13	46·97
Darbhanga	73,561	·99	·36	·41	·63	3·12	7·78	13·61	13·26	8·52	2·89	7·00	·17	51·74
Monghyr	57,077	·73	·63	·55	·40	3·46	6·83	13·65	10·38	10·19	2·47	·06	·11	49·46
Bhagalpur	69,106	·61	·70	·61	·68	3·87	8·10	14·33	11·18	9·56	2·24	·06	·07	52·01
Cuttack	47,186	·36	·80	2·50	·77	5·53	10·69	11·69	13·50	13·07	5·59	2·52	·25	67·27

The greatest amount of rain that fell during this period in any one day was 10·97 inches in September 1891 at Cuttack.

4. Another difficulty at present in introducing sewage farming is the strong prejudice that exists among the people against this mode of disposing of excreta, &c. This, however, may be left out of consideration, as advancing education will doubtless soon overcome it; the people of Bengal are extremely

intelligent, and will soon see that it is to their advantage to dispose of the excreta of their towns on the earth and by the action of vegetable life. There was at first great opposition against the present trenching system, but its advantage in the case of small towns is now recognised, and the results are satisfactory, even where the management of the trenching-grounds has been left entirely in the hands of the people of the country.

5. It will thus be seen that, however desirable it may be theoretically to introduce the system of sewage farming in India, there are considerable practical difficulties in doing so as far as Bengal is concerned. In localities, however, where laterite soil is available, the first two of the difficulties mentioned above do not occur, and there is no reason why sewage farming in such places should not succeed, notwithstanding the excessive rainfall that has to be contended against. In other places also, where the soil is alluvial, a great deal might be done, in order to render the land more suitable for sewage farming, by raising it and giving it a proper slope, as has been done for trenching purposes with marked success in Howrah and in the Cossipore-Chitpur Municipality north of Calcutta. With regard to the excessive rainfall at certain seasons of the year, which is the greatest difficulty we have to face, the only successful plan will be to separate it from the sewage as far as possible, which can be done by having two separate systems of drainage working side by side. One system should consist of covered or uncovered drains for the purpose of carrying off the rain water only; the other should be a system of covered drains for carrying off sewage, including, besides human excreta, all kitchen and household waste substances, the drainage from markets, bazaars and cowsheds, etc., and foul-water of all descriptions. The present surface drains in Bengal towns, though intended only for the removal of storm water, are, as a matter of fact, open sewers into which every form of sewage finds its way. Even human excreta is often to be seen in them. I think I may safely say that not more that ten per cent. of the sewage of Bengal towns is removed to the trenching-grounds; the rest finds its way into open ditches and hollows or soaks into the soil.

6. A town eminently suitable for a sewage farm is Dacca in Eastern Bengal, where I delivered a lecture on the subject in July last, recommending the introduction of this system of sewage disposal. The following extracts from that lecture may be of interest in connection with this paper :—

"It must be remembered in addition to the excreta to be removed from a house, fouled water, which is at least equal in quantity to the water-supply of the house, and which probably amounts to as much as eight gallons per head daily, has to be disposed of; besides these, there is the kitchen refuse, consisting largely of both vegetable and animal matters, to be taken into consideration.

"While all must be agreed as to the necessity for the immediate removal of excreta from the neighbourhood of dwellings, the best mode of doing so is by no means settled. The different plans may be conveniently divided into (1) the dry methods, and (2) the water method.

"The principal dry methods of removing excreta are :—

(1) The cess-pool system.
(2) The pail system.
(3) The dry-earth system.
(4) The privy system.

For a large town like Dacca there are many objections to these dry methods of removing excreta: (*1st*) Whatever dry method be adopted, the excreta are retained for some time in or about the house, instead of being immediately removed. (*2nd*) Although the initial outlay is less than in the wet method, there is the constantly-recurring expense of removing the excreta, &c. (*3rd*) Whatever dry method be adopted, sewers must always be provided to carry off the foul water, etc., from cook-rooms, and a certain proportion at least of the urine, and as the Army Sanitary Commission has said, speaking of barracks: 'To have two systems of cleansing stations—a foul-water system and a dry-earth system—would simply be paying double when one payment would answer; or, if all the excreta, solid and liquid, are to be carried away, this must be done at a cost ten times greater than that which would be necessary if all the excreta were removed by drains.'

"Whether the dry or wet method of removing sewage is adopted, drains for the removal of foul-water will be required, and it is found that they are open to the same objections as if they contained the solid excreta.

"In regard to the relative polluting effect of sewage from midden towns, as compared with that from 'water carriage' towns, the Rivers Pollution Commissioners of 1865 and 1868 say :—

"The analytical numbers show a remarkable similarity of composition between the sewage of midden towns and that of 'water carriage' towns. The portion of putrescible organic matter in solution in the former is but slightly less than in the latter, while the organic matter in suspension is somewhat greater in midden than in "water carriage" sewage. . . . . It seems hopeless, therefore, to anticipate any substantial reduction of sewage pollution by dealing with solid excrementitious matters only. It should, however, be noted that careful interception of excretal matter must tend to the lessening of the strength of domestic sewage.'

"It is clear that the water-supply of the town taken from the river must be polluted by the direct discharge into it of sewage, and that taken from the earth by means of wells must be polluted by leakage from cess-pools, privies, and defective drains.

"In dry methods of removing refuse, the kitchen refuse is commonly added to the excreta, and the two removed together. But the foul-water, and to a large extent the urine, remain to be dealt with, and require special means for their removal. In the case of Dacca no special provision is made for the removal of this foul-water and urine. The consequence is that it partially soaks into the soil and partially passes into the river, from which the drinking water of the town is principally procured.

"With regard to the dry-earth systems, the conclusions of the Committee appointed by the Local Government in England in 1875 to enquire into the various methods of sewage disposal were 'that the retention . . . of refuse and excreta . . . in cess-pools . . . or other places in the midst of towns must be utterly condemned; and that none of the (so-called) dry-earth or pail systems or improved privies can be approved other than as palliatives for cess-pit middens. . . . .'

"It will probably surprise most of you to hear that, taking the population of Dacca City at 82,321, as given in the last census figures, the total amount of excreta, etc., to be disposed of daily, is about 138 maunds of fæces, 2,058 maunds of urine, and 658,568 gallons, or 80 120 maunds of household waste-water. Under the present arrangements of removal a considerable proportion of the fæces and urine, together with the whole of the household waste-water, must pass into the soil around you and contaminate, in a very serious degree, the sites upon which your dwelling-houses stand. There are at present on an average 202 cart-loads of night-soil, washing water, urine, kitchen refuse, etc., removed daily to the trenching-ground. As each cart is capable of taking 7⅓ maunds of refuse, etc., 1,481 maunds are disposed of in this way during the day. As there are probably 138 maunds of fæces, 2,058 maunds of urine, 80 120 maunds of foul-water—total 82,316 maunds—to be disposed of, out of which 1,481 maunds only are removed to the trenching-ground, there remain 80,835 maunds which must soak into the ground around your dwellings, contaminating the soil. Bear in mind also the great risk you run, under the present system, of polluting, not only the soil and the atmosphere around your houses, but also the water in your wells and the water of the river which flows past the town, and from which your drinking-water supply is principally obtained. You have probably not forgotten the alarming outbreak of cholera which occurred here last year. I have not the least doubt in my mind that it was largely due to sewage contamination of the water.

"Turn also to the diarrhœa and dysentery heading of your vital statistical returns, which probably represents one-thirtieth part only of the suffering from these diseases, and you will see a high death-rate as compared with rural areas, which I venture to assert would not be the case if you had better arrangements for the disposal of your sewage. The diseases included in this group are particularly liable to occur where communities are closely packed, as in towns, and are not so prevalent in rural localities, where the inhabitants are scattered over a much larger area of country. Dysentery, and the allied diseases under this group, are contagious, through the stools of the patients, which again probably never communicate infection in the fresh condition, but only after being kept a day or two. It is, therefore, essential in the treatment of these diseases that the stools should be got rid of at the earliest possible time.

"The same remarks hold good for cholera. In its mode of prevalence and propagation it is very similar to dysentery, etc., not being contagious, except through the evacuations and vomit. The same precautions respecting the drainage arrangements of a house should be taken as in the case of dysentery; perfect cleanliness is essential; all evacuations should be removed as quickly as possible. All are agreed on one point, *viz.*, that these are filth diseases, and that they occur especially where the contents of cess-pits are allowed to remain stagnant and decomposed, and then obtain access to drinking water.

"That this amount of death and suffering is preventible to a large extent, I will give you an instance in point. In the Eastern Himalayas great suffering and loss of life are experienced from this group of diseases, and that it is to a very great extent preventible will be clearly seen by reference to the accompanying statement of vital statistics of Darjeeling, which have been accurately kept for some years past:—

"*Statement showing the annual mortality from dysentery and diarrhœa in the Darjeeling Municipality for the years 1889 to 1893.*

1	2	3	4	5
1889.	1890.	1891.	1892.	1893.
7·83	6·41	6 36	3·25	2·61

"Since 1888, when considerable attention was attracted to the subject, great improvements have been made in the drains of the town and the general conservancy arrangements of the place. The consequence has been that the death-rate under the heads dysentery and diarrhœa has steadily fallen from 7·83 in 1889 to 2·61 in 1893; and when you consider that there are probably thirty cases of sickness to each death, you will be able to realize the enormous benefit that has accrued to the inhabitants of the town from the attention that has been given to conservancy by the Municipal Commissioners of that place.

"Let us now examine the *wet method* of disposing of sewage. To start with, we have the assurance of Parkes that the water-carriage system is the cleanest, the readiest, the quickest, and, in many cases, the most inexpensive method. It may, indeed, be said that in small towns the dry removal, if properly carried out, may be the best, both for the inhabitants and the land; but where circumstances are favourable for its efficient execution, the water sewage plan is the best for large communities, such as Dacca. Certain conditions of success, however, must be present, without which this plan, so good in principle, may utterly fail. These conditions are that there shall be (1) a good supply of water; (2) good sewers; (3) ventilation; (4) a proper outfall; and (5) means of disposing of the sewer water.

"This brings me to the *disposal of the sewage* by the farm system, which is the final condition of the wet method I am advocating, and which, I may here mention, is advocated by the several Sewage Commissions, which have thoroughly considered the question in all its bearings. Let me read to you the following extracts from some of the principal reports on the subject:—

"'It will thus be seen that there is perfect unanimity in regard to the purification of the sewage by means of land. Irrigation in fact is the only method which at the same time purifies the sewage efficiently, and is not detrimental to the health of the people residing in the neighbourhood. The sewer water is allowed to flow at intervals over the land, different fields being irrigated in rotation, immense crops of grass, sugarcane, &c., being obtained from such irrigated land. The soil to be irrigated should have a gentle slope, the excess water being conveyed away by sub-soil drains into the nearest water-course. The sewage should be delivered in as fresh a condition as possible, and should be freed from its coarser portions by settlement or precipitation. The amount of land required is about one acre for the sewage of 100 persons. The irrigation must be on the intermittent plan, in order that the soil may undergo aëration, as it is only in this way that the best purifying results can be obtained.'

"I had the opportunity, while on furlough last year, of inspecting several sewage farms in England and was surprised, when passing through them, at the entire absence of nuisance. As far as the sanitary influence of sewage farming is concerned, the Sewage Committee of the British Association had returns from eight places where it is at work: 'In no instance has any disease whatever been traced either among the labourers on the farm or among the inhabitants in the vicinity, or among the cattle, to the sewage farm. In two instances it is reported that the health of the neighbourhood has improved, and in several that the land has very much improved in value, and the production of crops is much more certain.' These accounts are confirmed by the results of the enquiry into the sanitary aspect of sewage farming given in the report of the judges in the sewage farm competition, 1879. From the returns of nine sewage farms it appears that 'the rate of mortality on an average of the number of years which these farms have been in operation does not exceed three per 1,000 per annum' The judges observed that 'this is a very low rate, but in all probability it may not be lower than would be found in an equal number of selected lives taken from an agricultural district. The results of the sanitary enquiry show that sewage farming is not detrimental to life or health.' It is necessary that the rain water, or at least a part of it, should be diverted into natural water-courses without passing through the sewage works.

"I have no doubt that a sewage farm situated on the laterite soil north of Dacca would, if properly supervised, be a very satisfactory institution; and I would, in conclusion, strongly recommend you to try it. The land being well raised and permeable, is eminently suited for such a purpose, as you may judge for yourselves from the following extract of its formation, which I have made from an interesting article in the Statistical Reporter, written in 1877 by the Hon'ble Mr. Cotton, who is at present Chief Secretary to the Government of Bengal:—

" 'One of the most interesting natural features of the Mymensing district is the forest tract called by the Europeans of the district the Madhupur jungle, from a small town so named, through which the Mymensing post road passes just before entering the forest. This tract, so impressive from its contrast with all its surroundings, is an extensive *sâl* forest, commencing some ten miles south of Jamalpur on the Brahmaputra, and extending without a break for 80 miles to the southern boundary of Mymensingh, and thence through Bhowal in Dacca for 25 miles further. Within a few miles of the city of Dacca it terminates as abruptly as it commenced. Its breadth varies from 8 to 20 miles, averaging 15.

" 'This jungle country is a plain for the most part, only slightly undulating, and little raised above the general level of the surrounding country.

" 'Nowhere, perhaps, is the influence of physical circumstances upon economic history more strikingly displayed than in this island of laterite in the alluvial plain, an unreclaimed forest in a fertile country, a waste peopled by scanty and half-savage tribes in the midst of one of the wealthiest of Bengal districts inhabited by Bengalis of pure descent. The forest is probably the only non-alluvial tract that lies actually within the otherwise uninterrupted expanse of the great deltaic plain of Bengal. It consists simply of laterite unstratified and unfossiliferous. The appearance of laterite in this part of the delta seems strongly to suggest that the laterite formation of the western districts is continuous, at great depth, under the whole deltaic plain, to reappear in the Garo Hills, and that the Madhupur forest is in fact the summit of a lofty and extensive plateau of upheaved laterite, which formed an island in the laterite sea, and which has now been buried to within 30 feet of its summit in the alluvial deposits of the Bengal delta.'

"No more suitable ground could be found anywhere for a sewage farm."

SEWAGE FARMING IN MADRAS, AND THE SUITABILITY OF THE SYSTEM FOR INDIA.

BY J. NIELD COOK,

Madras.

How to dispose of sewage has always been a problem of paramount importance. I do not propose to discuss the laws of Manu or Moses or matters of ancient history. For my present purpose sanitation may be said to have commenced in the latter half of the century. In 1857 the Royal Sewage Commissioners laid it down as an axiom that "the right way to dispose of town sewage is to apply it continuously to land." However, considerable difficulties were experienced in putting the principle into practice. The heavy soils found in most parts of England, the abundant rainfall throughout the greater part of the year, the low temperature during the winter months, when vegetable life is practically at a standstill, and the difficulty and expense of acquiring suitable lands of sufficient extent in the natural direction of the drainage, have prevented the application of the sewage to the land becoming in any sense general. In 1875 the Committee appointed by the local Government Board to inquire into the various methods of sewage disposal reported, "that land irrigation is not practicable in all cases." The object of this paper is to show that the adverse conditions, which prevented the general adoption of this method of disposing of town sewage in England, are for the most part absent in India. A trial extending over a quarter of a century has been made in Madras, where the local conditions are in no way exceptionally favourable, and has proved that an almost unlimited amount of sewage can be disposed off in this way in accordance with the best hygienic principles; and, further, that the produce of the farms finds a ready market, and realizes a handsome profit on the outlay. At the same time I hope to give such practical details as will enable any one to make a more or less extended trial of the system with good prospects of success.

The idea of adopting land irrigation as the means of disposing of sewage in Madras was conceived by Mr. Standish Lee, the Municipal Engineer, in the year 1869. No worse site could have been found anywhere about Madras than that of the first experiment. This was in the neighbourhood of Chulay, and is now known as the D'Mellow's Road Farm. It was a dismal swamp periodically submerged by salt water, which on evaporation deposited a saline mud. The soil was black, plastic, and as retentive as stiff clay. Not even a blade of grass grew there. Operations were commenced in June 1869. The swamp was reclaimed by depositing street sweepings, and was planted with guinea grass. Some crops were obtained, but subsequently difficulties were encountered ; with the advent of the hot weather of 1870, evaporation increased considerably, and salt was drawn to the surface, forming a saline efflorescence, if the ground was allowed to rest a few days. A large quantity of guinea grass perished and some harrialie, or dhoob, that had been planted, was not strong. A coarse swamp grass sprang up which is known as cow grass (*Chloris barbata*), and is liked by cattle, though unsuitable for horses. Moreover, the surface sank irregularly, throwing out the grading of the beds and necessitating a large amount of manual labour. Later on inspection was made by an agricultural expert, who traced the main cause of the want of success to the sub-soil water, which was found in some parts of the farm at from four inches to two feet from the surface. The worst parts of the farm were underdrained at intervals of six feet, with pipes running four feet from the surface, which was raised by the deposit of rubbish, and after this no further difficulty was experienced. My own opinion is, that the drained pipes in this case were of little or no use, as they were placed below the level of the sub-soil water and had no outlet. The whole neighbourhood is low and swampy, and at the present time water is found at from eighteen inches to two feet from the surface.

The next experiment was made in 1870 at Krishnapett near the seashore. Half the land taken up consisted of pure sea-sand, the remainder of land which had been reclaimed with rubbish and covered with a thin stratum of sand. Here no difficulty was encountered, the soil being porous and permitting the great desideratum of sewage farming free downward percolation, Heavy crops were soon raised, amounting in 1871-72 to about 69 tons of grass per acre. Since then a number of farms have been started, the principal one being known as the Black Town Farm. This is admirably situated on the beach 2½ miles north of the town. It is so close to the shore that last year a considerable portion of it was carried away by a heavy sea. The farms now in use, and the areas they drain, are shewn in dark and light colours on the accompanying map. It will be noticed that some of them are inhabited areas and are of comparatively small size. This is due to the want of any general system of drainage in the town. In my opinion the fundamental principle for any system of sewage for Madras should be to carry all the sewage to the north and dispose of it on one large farm, which could be made by the extension of the present Black Town Farm. This would be more economical, and in other ways preferable to having a number of small farms scattered over the town.

Successful sewage farming is to a considerable extent dependent on physical conditions. The geology and surface of Madras are thus described in a recent report by Mr. Edward Cousins, C.E. : "The surface and sub-soil consists, as a rule, of deposits of white and grey sand, in which occur at irregular intervals thin beds of clay. Water is found below the surface at varying depths, but generally in the low-lying parts of the districts it corresponds with the mean level of the sea. At no part of this sandy plain are there any considerable elevations of the surface ; the maximum heights are from twenty to twenty-four feet above mean sea level, while many portions of the town are only two feet to six feet above that level. The average elevation of the surface may be taken at about nine or ten feet." The higher parts of the Town being principally occupied by private houses with large compounds have no drainage system, provision only being made for storm water. The parts providing sewage to be disposed of are all, if anything, below the average height given, which necessitates the lifting of the sewage by pumps, either from central pumping stations or from wells on the farms, which is a costly undertaking. At first only the water lift of the country was used. This is known as the "picottah," and consists of a lever balanced on a strong upright and worked up and down by men stepping from one side of the fulcrum to the other. But for any kind of manual pumping to be successful, constant supervision is required, and now for the principal farm, this primitive system has been superseded by the steam pump which is in every way more satisfactory. Gwynne centrifugal pumps have been found to answer best. The Royapuram Pumping Station, from which the sewage of Black Town is pumped to the Black Town Farm, is fitted with three of them, each 15 inches in diameter. The sewage is lifted from a well, into which three sewers empty their contents, and discharge into a cast iron main 24 inches in diameter and about a mile and a third in length, being carried the remainder of the distance of 2½ miles in an open masonry channel. No further lifting is required after the sewage reaches the farm. Pumping at this station is carried on an average 22½ hours daily, the amount of sewage pumped being about three million gallons. Night soil is removed on the pail system, and is not supposed to enter the drains, though the urine and washings of the latrines do so. The annual rainfall varies considerably, the average being about 50 inches, which is above the general average for India. A very large proportion of it falls between the middle of October and the middle of December.

As I consider the Black Town Farm to be a fair model for an Indian sewage farm, I shall describe it somewhat in detail. The sewage passes from the outfall channel through culverts with sluices into the main carriers. These are banks of earth with a channel scooped out on the top. They run in parallel lines about 432 feet apart, giving off at right angles the secondary or distributing carriers, which are similar but somwhat smaller. The interval between the distributing carriers is 114 feet, and it is divided into two by a small bund, which runs through the beds half way between them. This may be called the central bund. The beds slope down to it from the distributing carriers. It is absent in some of the farms, but I think it is a good thing to have it as the grass may rot at the lowest part of the slope through the water standing there longest. It percolates through the bund, and so this is avoided. There are further bunds at intervals of six to eight feet, running from near the distributing carriers down to the central bund. These are small and not more than four to six inches in height. They conduce to the equal distribution of the sewage over the grass. The junction of a distributing carrier with a main is made with a stoneware drain pipe of about six inches diameter. Grass grows freely over the bunds and over the carriers to the very edge of the channels, which become coated with a black sludge which hinders the sewage from sinking in, though it allows enough percolation to keep the grass growing freely over them. Large drain-tiles have been laid in some of the carriers, but they soon get displaced and serve no good purpose. The gradient of the carriers should be sufficient to ensure a fairly rapid flow without causing a scour. Where the amount of sewage to be disposed of is small, the beds should be made somewhat smaller than the measurements I have given in order to get an even distribution of the sewage. The slope from the distributing carrier to the central bund is about one in thirty.

The system of irrigation which has been found to answer best is to flood the beds heavily every three or four days, though it can be done oftener without any ill-effect. The method employed is to open the sluice in the outfall channel and let the sewage run into a main carrier. The drain pipes leading to the distributors to be used are left open, those which are not to be used are closed with earth and grass. If only the first part of a main carrier is required, it can be bunded across at the required distance with earth. The same can be done with a distributor, which is then breached behind the carrier, and the sewage pours out and runs down the space between the distributor and the ends of the bunds that divide up the beds, and turns off between these bunds to run down the beds to the central bund. The men in charge of the farms say that they put on about four inches at a time, but the amount must be much larger, as a good deal of sewage sinks in before it begins to lie on the surface. This method of intermittent irrigation economises the labour on a large farm, as only a third or a quarter of it has to be attended to every day. It also gives plenty of time for air to be drawn into the interstices of the soil and provide the oxygen which is necessary, both for nitrification and the formation of tissue. Most cultivators irrigate equally all the time a crop is growing, but one of great experience told me that the younger the grass the more sewage it will take. The grass should not be irrigated for two or three days before it is cut. This allows it to harden, and though it does not weigh quite so much, its quality is better and it does not wither so quickly. After the grass is cut, which is done in Madras with a sickle, with a saw edge, the teeth being set the contrary way to an English saw, the ground should lie fallow for the best part of a week. The careful farmer will then take the opportunity of forking it and loosening the roots, though in some farms this is not done more than once a year. It favours the development of young roots to replace the old ones, and so preserves a healthy and vigorous growth. The beds should also be weeded. If this is done regularly it entails very little labour, but if it is neglected there may be some difficulty experienced. The grass is generally cut rather before it reaches maturity. The contractor reckons to cut a crop every forty-five days, which gives eight crops a year. In the Municipal Parks, where sewage irrigation is carried on, we do not get quite so many. The method of irrigation by blocking the channels with earth and breaching them is primitive, but it suits the native cultivator, who is very skilful with it, and it has been found to answer the purpose ; so no attempt has been made to supersede it and introduce iron or wooden stoppers.

Some of the three million gallons of sewage daily pumped at the Royapuram Station is drawn off to irrigate the Robinson Park ; the remainder goes to the Black Town Farm. Adding together the area of the Park, the farm, and of certain private lands adjoining the farm which are irrigated by the contractor, we get a total of 40 acres approximately. This gives a daily average of 75,000 gallons per acre. The experience of the Berlin Farms is that not more than 2,000 to 3,000 gallons of daily sewage should be allotted per acre, so that the land may have the necessary periods of rest. At the Bedford Farm in England about 5,200 gallons per acre are pumped daily and at the Beddington Farm about 6,600 gallons, which is the largest amount I know of outside Madras. Yet the Madras contractor, who is getting twelve times as much sewage per acre as any European farm would stand, recently petitioned to have sewage irrigation stopped in the Robinson Park on the ground that he was not getting enough. This is a remarkable testimony to the porosity of the soil and the copious evaporation and transpiration that take place under the influence of the Indian sun. At times when I have visited the farm, especially after heavy rain, all the sewage was not being used, the surplus running into the sea at a point beyond the farm. The sewage which is used to irrigate the farm does not form a definite effluent, but on careful examination I have found tiny rivulets trickling down from near the bottom of the wall of sand in which the farm ends where it drops down to join the seashore. The amount is so small that it was a long time before I noticed it.

As regards the crops that do best, though it has been found that nearly everything will grow under sewage irrigation, yet later experience has confirmed the verdict of the early experimenters in Madras that harrialie grass (*Cynodon dactylon* ; Hind, *Dhoob*) is by far the most satisfactory. It has the advantage of being indigenous, for English and French experience has shewn that the peculiar crop, whatever it may be, that suits the neighbourhood, seems to flourish under sewage. It is, moreover, a voracious feeder, and is not easily killed by excess of sewage. In the wild state, in places where there is not much moisture, it creeps for the most part below the surface of the ground. Native ponies may be seen scraping the surface of the ground with their hoofs and blowing away the dust to get at it, and will graze where there is not a blade of green grass to be seen. But, when abundantly irrigated, it shoots up to a height of two feet or more and yields most luxuriant crops. Capt. Horace Hayes, F.R.C.V.S., says of it in his book on Horse Management in India: "In good soil, when cultivated, it loses its creeping character and grows like English meadow grass, to which I think it is much superior." A good farm yields about 45 tons of green grass per acre which dries down to about 15 tons of hay. This compares very favourably with the Berlin farms, which yield 25 tons of grass or 5 tons of hay. From this it would appear that the grass grown in Madras contains less water than that grown in Germany. The English sewage farms yield about the same amount of hay as the German ones. This is about double the yield from English meadow land. So where we get one ton of hay from meadow land, we get two tons from European sewage farms and six tons from Madras sewage farms. This enormous difference may partly be attributed to the season of growth being continuous in India, whereas in Europe it is limited to the summer months, and partly to the fact that a high temperature in a soil or water up to 99° F. increases the activity of nitrification and consequently of vegetable growth. The hay from the Madras farms is mostly sold to the Commissariat at Rs. 45 a ton. This gives an average money yield of Rs. 675, or about £37 sterling per acre, taking Rs. 18 to the pound, against £18 per acre, which is reported to be the average price of Italian rye-grass grown on the Bedford sewage farm. When the differences in the cost of land and labour in the two countries are taken into account it is easily seen how it comes to pass that sewage farming is so much more profitable in India than in England, for we have double the produce on probably less than a quarter the outlay. Besides the supply of hay to the Commissariat there is a fair market for grass and hay among horse-owners in the city, especially during the hot weather when grass is scarce.

With regard to the quality of our sewage farm hay as forage, I wrote to Veterinary-Major W. Gladstone, A. V. D., the officer in charge of the horses of H. E. the Governor's Body Guard and the Royal Artillery at Saint Thomas' Mount, who replied :—

"Since hay from the sewage farms has been used at the Mount there has not been a single case of anthrax until this year, when on inquiry I found that one of the Majors was using grass-cutters' grass. This was stopped, and since then we have not had a case. The same in the Body Guard. I strongly recommend hay from the sewage farms, as diseased cattle are not allowed to stray over the land, and it is by far the best forage you can get in Madras. Veterinary-Colonel J. V. S. Shaw says that wherever dry hay has been used anthrax has not been known, and certainly I have not seen a case. In Belgaum in 1878 we had anthrax, and as soon as the grass-cutters were discharged, it ceased, and has not recurred since. The same in Bangalore, except when they are compelled to use green grass, as in camps of exercise, &c. So I believe the drying process and keeping diseased cattle off the land has a great deal to do with this immunity."

Other Veterinary-Surgeons, with whom I have discussed the matter, have spoken equally in favour of sewage farm hay.

Harriali grass grows better from roots than from seed. The roots should be planted in rows about six inches apart. It spreads quickly, and in about two months a light crop can be cut. If it is planted in a soil recently made by the deposit of rubbish, the irrigation should be somewhat excessive, daily will not be too often ; otherwise the heat due to fermentation may kill the grass. It is advisable to let rubbish rest for six months or more before planting it, otherwise the level of the beds may be thrown out through its sinking irregularly. After planting, if the beds keep their level, there is nothing further to be done beyond weeding and forking. Beds, both of sand and of made soil, planted more than twenty years ago, are still yielding good crops, though, so far as I know, they have never been ploughed up or replanted. If a bed sinks in any part a few cart loads of rubbish will restore the level. If caterpillars appear, as they occasionally do about the end of the rainy season, a little freshly-slaked lime will quickly put an end to them, failing which ashes are as good as anything.

About 50 acres of land are leased to a contractor. The amount was larger, but two farms have been abolished, as the sewage supplied to them was carried to the Black Town Farm after the opening of No. 2 Sewer, and a considerable portion of the Black Town Farm was carried away last year by the sea. Eleven acres more are being acquired to be added to the Black Town Farm. The contractor also irrigates about 20 acres of private land, part of which he leases from the owners, and part he holds under an agreement with the Commissariat. The land in three public parks, which is worked departmentally, brings the total area of sewage irrigation up to about 100 acres.

Complaints of nuisance have been made against some of the Madras farms as against sewage farms in other places. There is an ammonical smell from the sewage wells and main carriers at times, but apart from this the air over the farms themselves seems perfectly fresh and wholesome. No one with his eyes bandaged could perceive by the sense of smell that he was walking over a sewage farm. With regard to the sanitary aspect of the question there have always been differences of opinion. The Sanitary Commissioner for Madras appears to have a bad opinion of the Madras farms. For in his Annual Report for 1893, page 115, he writes : "Madras town pursues the system profitably but on bad sanitary principles ; the sites being often within inhabited areas, no arrangement being made for under-draining and discharge of the affluent, and in certain cases disposal by soakage in the neighbourhood, or discharge into the Cooum being allowed during intermitting working of the pumping machinery." For my own part I think the

Black Town and Krishnampet farms would compare favourably with farms in any part of the world. I cannot understand on what ground a charge of bad sanitary principle can be preferred against them. With regard to some of the farms being within inhabited areas, I have not found that the health of the people living near them is worse then elsewhere. Taking cholera as a disease specially prone to appear under insanitary conditions, spot maps showing the mortality do not indicate that the disease has shown a special preference for the neighbourhood of the farms There is nothing to show that diarrhœa, dysentery, typhoid or diphtheria specially affect these localities. Dr. Alfred Capenter, who has had a practical experience of thirty years or more and made a special study of the question in connection with the English farms, lays it down as a proposition that the judicious application of sewage in close proximity to dwelling house does not depreciate the health of the inhabitants." "In no single instance," he said on one occasion, "out of nearly 100 cases in which sewage has been utilized by broad irrigation has any fact been proved to establish the allegations of 'insanitariness' which are sometimes brought against them." There is a Female Orphan Asylum with 200 inmates on the border of the Croydon Farm, and the health of the children is said to be unaffected. Many lunatic asylums utilize their sewage on their own grounds with excellent results. The General Hospital, Madras, has diverted its sewage from the river Cooum, and employs it to irrigate a strip of land close to some of the buildings. The result is a vast improvement to the appearance of the place, and I have not heard that any complaints have been received from officers of the medical or surgical staff that the health of their patients has been injuriously affected. I think they give Surgeon-Colonel Price considerable credit for the innovation. It will be seen from the map that most of the farms within inhabited areas are small. Most of them are irrigated only by means of picottahs, which limits the supply, and I believe that in India, unless the supply is very abundant, very little, if any, water reaches the sub-soil water. These farms will doubtless be abolished, and the Black Town Farm extended, when a comprehensive system of sewerage is introduced. For the present I believe they serve a useful purpose in utilizing sewage that would otherwise be discharged into the river or canals, or soak into and pollute the ground. With regard to under-drainage, its objects are to prevent the soil from becoming water-logged, which ruins the crops and prevents the proper exercise of its purifying action on sewage, and to enable a larger quantity of liquid to be disposed of. It has never been successfully employed in Indian agricultural operations. A trial made at the Sydapet Experimental Farm showed that its efficacy was soon destroyed through the pipes getting blocked by white ants, etc. It is quite unnecessary in a highly permeable soil that permits free percolation. In the Berlin farms it was not adopted at first, but was subsequently resorted to when the soil got waterlogged, 2-inch pipes being laid 16 to 33 feet apart at an average depth of 3 to 4 feet. In most of the Madras farms there is no water to be found under 5 or 6 feet, and I have dug down to a depth of 10 feet close to where irrigation was being carried on without getting any accumulation. There is no impervious stratum under them for a considerable distance down, D'Mellow's Road being an exception, as it has an impervious stratum, and is only slightly raised above the surrounding swamp. In England and Germany it is found that less than half the sewage used for irrigation flows away as an effluent. In India the proportion must be very much less, as evaporation and transpiration are enormously increased under the influence of the tropical heat.

This enables us to use large volumes of sewage for irrigation without underdraining and without appreciably raising the level of the sub-soil water. I know of an instance in which a small sewage farm was started which was irrigated daily. A well within a few yards of the farm, which was used for irrigating a plot of grass, had to be deepened to get water enough for the purpose, which would not have been necessary if the sub-soil water level had been raised by the percolation of sewage through the ground exceeding the amount given off by evaporation and transpiration. In India if the sewage to be disposed of is too much for the land it is better where possible to extend the farms rather than to increase the effluent by underdrainage.

The drains leading to the Napier Park and People's Park have overflows into the Cooum, by which the sewage enters the river at night, when the pumps are at rest, and during heavy rains. So have the drains leading to two small picotta farms, Pudupet and Dam's

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NOTE.—Some idea of this can be got from the following extract from a paper by Messrs. Lawes, Gilbert and Warrington in the Journal of the Royal Agricultural Society of England 1881:—

"As the transpiration of water in a plant is determined by light the amount of transpiration must have some connection with the rate of assimilation and growth. When the supply of water and of soluble plant food is tolerably constant the relation between transpiration and growth will be fairly regular. From experiments made at Rothamstead many years ago with plants grown in pots it was concluded that from 250 to 300lbs. of water were evaporated for 1lb. of dry matter added to plant. It may be, however, that in a soil poor in soluble plant food a larger amount would pass through the crop to yield the same amount of assimilation than in a soil well manured. The relation between transpiration and assimilation will indeed probably differ under different circumstances." The soil in the Black Town farm containing practically no soluble plant food, the amount of water transpired might be expected to be large. Taking into account the intense brightness of the sun light it would probably be within the mark to estimate it at double the amount given above. An acre yields 15 tons of dry matter; this would give 15 by 600 tons of water transpired,

9,000 tons = 20,160,000lbs., or 2,016,000 gallons per annum = $\frac{2,016,000}{365}$ gallons a day = 5,523 gallons, day. The amount lost by evaporation in India, which averages 0·22 of an inch, should be added to this. This is 49,240 gallons an acre and is probably more than actually evaporated, as water is not always standing on the beds. On this reckoning transpiration and evaporation together would daily amount to 54,803 gallons per acre or more than two-thirds of the sewage water allowed for irrigation. 21,197 gallons would be left to join the sub soil water. The amount lost by transpiration is probably more than the estimate.

Road. It is proposed to introduce storage tanks to intercept the sewage that now escapes into the river, which is inconsiderable in amount. I do not know what is referred to by disposal by soakage. In some parts of the town there is soakage, but this is due to the want of proper drains and not to sewage farming on bad sanitary principles. Sewage farming can only be held responsible for the disposal of sewage when it reaches its destination and not for defects in the sewerage and drainage of a town.

The price paid for land for sewage farming in Madras has not been high, and from what I have seen of other Indian towns I believe that cheap land suitable for the purpose would generally be procurable. In the Madras farms there are practically only two types of soil, sand and made soil. They are both porous in a high degree and to about an equal extent. To test their porosity and their purifying action on sewage I recently performed some simple experiments. I had four filters or guages made, each consisting of three 9-inch drain pipes joined together and cemented so as to form impervious cylinders rather more than 6 feet in length. These were placed perpendicularly on wooden stands with perforated iron plates intervening, and galvanized iron buckets were placed underneath. Two of these I filled with earth from the Robinson Park and the other two with sand from the Black Town Farm, first putting a few pebbles and pieces of broken pot at the bottom. On the top I put grass from the farms, partly, as I believed it would act as a strainer, partly, in order to obtain any action the roots might have upon the sewage as it passed over them, and generally to reproduce as nearly as possible the natural conditions of a farm. The soil of the Robinson Park was originally street sweepings; it is now a rich and friable loam of a dark brown colour. The soil of the Black Town Farm was originally sea-sand, and as far as its physical characters are concerned, it has practically undergone no alteration, though subjected to sewage irrigation for over a decade. I put sewage in at the top and caught the effluent water in the buckets at the bottom. The time taken by the sewage to pass through varied somewhat, its first appearance being in two to three hours when the soil was comparatively dry and half to one hour when it was fairly moist at the time of starting the experiment. It passed through the made soil quite as quickly as through the sand, which was contrary to expectation. I began by putting two gallons of sewage pint by pint into each filter. About half of it was absorbed by the soil almost immediately, the remainder stood on the surface and percolated down much more gradually. As soon as it began to come through the first filter I added a gallon more to each to get enough effluent for analysis. I sent samples of the sewage used, which was taken from the well in the Royapuram Pumping Station, and of the effluents to Surgeon Major J. L. Van Geyzel, M.B., F.C.S., Chemical Examiner to Government, who very kindly analysed them for me. The following are the results of his analysis :—

ANALYSIS.—*Parts per* 100,000.

	SUSPENDED SOLIDS.			DISSOLVED SOLIDS.			Chlorine.	Free Ammonia.	Albuminoid ammonia.	Nitric acid.
	Organic.	Inorganic.	Total.	Organic.	Inorganic.	Total.				
Filtered effluent sandy soil from Black Town Sewage Farm ..	0·100	1·600	1·700	205·000	555·000	760·000	269·800	0·120	0·220	8·670
Sewage from Royapuram Pumping Station	12·700	19·700	32·400	66·000	299·000	365·000	170·400	5·200	0·560	0·210
Filtered effluent (No. 1 Filter) made soil from Robinson Park Sewage Farm	trace.	0·200	0·200	117·000	304·000	421·000	138·400	0·024	0·056	16·920
Filtered effluent (No. 2 Filter) made soil from Robinson Park Sewage Farm . ..	trace.	0·400	0·400	105·000	280·000	385·000	120·700	0·019	0·064	16·500

The character or source of the organic matter cannot be inferred from the above analyses in the absence of determinations of the amount of organic carbon and nitrogen. Owing to the short space of time unavoidably allowed to the analyst these determinations had to be omitted. The filtration performed in the experiments was necessarily imperfect. The soil in the filters was much less compact than that in the farms, where it had been rained upon and irrigated for years. If I had had the means available of isolating sections of the farm without disturbing the soil and had been able to utilize a larger area in proportion to the sewage used, I believe that the effluents obtained would have been purer. The sewage put on, two gallons to an area of 63·6 square inches, is equivalent to 591,750 gallons an acre, which is seven times as much as the average daily amount put on the Black Town Farm, or more than twice the amount used at a flooding done every three days. The sample of sewage analysed contained rather less suspended matters and free ammonia, much less combined ammonia, and much more matter in solution and chlorine than are contained in English sewage of average composition. At the same time the results obtained amply demonstrate the purifying powers of the soil, and are in the main in accordance with the results of English experiments. The effluent water was clear, odourless and practically colourless. The analysis shows that it contains less suspended organic impurities and much less free and albuminoid ammonia than the sub-soil water in parts of Black Town, of which I have analyses. It would so far pass the standards of purity adopted by the Commissioners appointed to inquire into the best means of preventing the pollution of rivers. The most noteworthy point, whether from the point of view of the sanitarian or of the agriculturist is the retention by the soil of the suspended organic matter and ammonia in solution and the appearance in the effluent of nitrates. According to modern theories, based on the experiments of MM. Schlæsing and Muntz and Messrs. Lawes, Gilbert and Warrington, this is due to nitrification brought about by the presence of living organisms, which specially occupy the first 18 inches of the top soil. The vital activity of these living ferments varies with the temperature, being very low near freezing point and reaching its maximum at 99° Fahr. I have not got reliable records of soil temperatures in Madras, but a few days ago (early in November) I took some temperatures of the soil on the Black Town Farm in the early morning, which were over 80° Fahr., so that it is probably between 80° and 100° Fahr. generally, which is the most favourable temperature for the process, and so in the highest degree conducive to the purification of sewage. In a paper read before the Society of Arts in 1882, Mr. Warrington pointed out that "a filtering medium of pure sand and limestone, treated intermittently with sewage, will, after a time, display considerable purifying powers, the surfaces becoming covered with oxydising organisms derived from the sewage. No such medium will, however, equal in effect a porous soil rich in organic life." This explains what might seem strange in the results of the analysis, that the effluent from the made soil contains much less unoxydised nitrogen than that from the sand. The experiments of the Rivers Pollution Commissioners with soils from different farms appear to show that the cleaning power of a soil is more closely connected with its physical condition as regards porosity and fineness of division than with its chemical composition, and of two soils not differing very widely in chemical composition, namely Hambrook and Dursley, one (the latter) was found to have twice the purifying power of the other. Judging from my experiments it would appear that made soil, which is the finer and richer of the two, had a greater purifying power than sand, and, as the porosity is about equal, though both are admirably suited for sewage farming; where both were available, made soil should be taken by preference or sand might be covered with sweepings to a height of one or two feet to give it a more active nitrifying surface stratum. Presumably, the nitrates in the effluent were in the soil when it was taken from the farm, and were the result of former nitrification and not produced from the organic matter and ammonia in the sewage used in the experiments. The large amount of chlorides is probably due, partly, to the urine contained in the sewage and partly to the proximity of the sea. The amount in the effluent from the Black Town Farm soil, which was taken from a spot about 200 yards from the sea-shore, was more than double that of the Robinson Park, which is more than half a mile from the sea. These experiments, imperfect as they were, and the analysis made by Dr. Van Geyzel, convince me that what little effluent percolates through our farms may safely be allowed to join the sub-soil water without any fear of polluting it, and in any way endangering the public health. I have already shown good reason for believing that there is not very much of it that the water level is not appreciably raised, and that the crops are healthy and vigorous. Hence, so far as I can see, no reason exists for underdrainage, which would, moreover, entail great difficulties and expense; for the ground is in many of the farms so level that the effluent would not run off, so that it would have to be pumped, and there would be nowhere for it to go to, unless it were thrown on to the beds again, and so be sent round and round in a vicious circle.

Under the arrangement with the sewage farm contractor the Municipal Commissioners undertake to pay the rent, establishment and labour. The contractor must keep in repair the sewers, drains, cisterns, channels, pipes, and other things connected with the delivery of sewage in or on the farms. He must dispose of as much sewage on the land as the Commissioners deliver. He must cultivate and manage the farms in the most approved manner and keep them in a clean condition, free from weeds, etc. He must allow free access to the farms to the officers and servants of the Municipality, in order that they may see in what state the farms are kept, and whether any part is in need of repair, and, if so, to give notice to the lessee, who must execute the repairs within fifteen days. The contractor has the right of constructing new wells, cisterns, etc., if he first obtains consent for the proposed work. The Commissioners agree not to stop the delivery of sewage at any one time for a longer period than five days. The contractor is allowed to cultivate or irrigate with sewage other land than Municipal land with the consent of the President, and pays to the Commissioners Rs. 250 per cawnie (1 cownie=1·322 acres) per annum for lands so cultivated. The contractor has to cultivate and irrigate any other land acquired, rented or handed over to the Municipality, and pays the Commissioners Rs. 300 per cownie per annum for lands so cultivated. The contractor makes a deposit of a Government of India Promissory Note for Rs. 4,750 as security. Deductions may be made from this in the event of a breach of contract.

The contract system, which was introduced in 1888, has been found to be more profitable than working the farms departmentally. The usual objection to it is that a contractor has an eye only to profit and will not use all the sewage on the farms for fear of injuring his crops. No trouble has been experienced from this cause in Madras, partly through the voracity of harriali, and partly through the well-known prodigality of the Indian cultivator in the matter of irrigation. One contractor allowed weeds and objectionable kinds of grass to gain ground, especially a kind of swamp grass with strong interlacing roots (*Panicum fluitans*) which gained a hold in the D'Mellow's Road farm, and to a less extent cow-grass (*Chloris barbatta.*)

The farms are put up to public auction triennially. At the first sale in 1888 Rs. 7,250 per annum, or Rs. 21,750 for the whole period, was the highest bid. On this if the cost of pumping on the farms be included there was a loss on the three years, as shown below :—

INCOME.	Rs.	As.	P	EXPENDITURE.	Rs.	As.	P.
	21.750	0	0	Establishment ...	1,920	1	9
Loss ...	19,239	11	6	Overtime .	153	10	8
				Filters' Staff ...	721	1	3
				Labour (including pumping) ...	33,414	5	10
				Rent of Sewage Farms ...	2,780	8	6
Total ...	40,989	11	6	Total ...	40,989	11	6

This shows a loss of Rs. 19,239-11-6, or rather more than Rs. 6,000 a year. In 1891 the better price of Rs. 15,600 per annum, or Rs. 46,800 for the three years, was obtained. On this an actual profit of Rs. 18,307 was realised, the expenditure having been somewhat reduced. In 1894 the farms were let for Rs. 19,000 per annum, or Rs. 57,000 for the three years. The following is an estimate of the income and expenditure for the period :—

INCOME.	Rs.	EXPENDITURE.	Rs.
Rent of farms ...	57,000	Rent, maintenance, &c. ...	30 630
Private lands ...	14,850	Profit	46,532
Added land (2½ years)...	5,312		
Total ...	77,162	Total	77,162

The estimated profit for the period is thus seen to amount to Rs. 46,532.

The conclusions I draw from the evidence adduced are as follows :—

1. Barren land can be acquired at a moderate cost in the vicinity of most Indian towns.

2. No matter how barren the land is, if it is permeable, it can be utilized for the formation of sewage farms.

3. Sewage farms in India can be laid out at small cost, a maistry with a gang of coolies being able to do the grading of the beds and make the bunds and channels.

4. Owing to growth being continuous, more crops can be raised in India than in Europe, and sewage can be more satisfactorily disposed of in large quantities throughout the year.

5. Owing to the temperature of the soil being particularly favourable to nitrification and growth, in the presence of sufficient water, the crops are very heavy.

6. Owing to the scarcity of good forage, during a great part of the year, there is usually a good market for grass and hay.

7. Owing to the exclusion of diseased cattle from the farms, grass and hay are not liable to infection with disease germs. They compare favourably as food stuffs with forage from other sources.

8. Sewage farming can be carried on in the proximity of houses without affecting the health of the residents, though it is better to locate the farms at a distance from a town, as there may be some nuisance from the sewage wells and main carriers owing to the decomposition of the sewage before it reaches the farms.

9. Owing to the porosity of the ground and the enormous volumes of water given off by evaporation and transpiration underdraining is not generally necessary, though it may be in particular cases.

10. Sewage after passing through the ground is sufficiently purified to be admitted into a river, or to join the sub-soil water without causing pollution.

11. The native cultivator is quite capable of laying out farms and carrying on sewage cultivation without close European supervision. He is an adept at irrigation processes, having inherited his aptitude and familiarized himself with the methods almost from the time of his birth.

12. The system is suitable to parts of India where the ground is permeable and the rainfall is not excessive. It can be carried on profitably, even where the flatness of the land necessitates the use of pumps, and should yield a much higher profit, where the natural slope of the land permits them to be dispensed with.

DAIRY PRODUCE IN INDIA.

BY P. W. O'GORMAN,
Surgeon-Captain, I. M. S.

If there be any article of diet in India that needs more than any other the earliest and most stringent regulations to be enforced against disease and adulteration, I claim them for our dairy produce—produce on which by far the largest proportion of our population, European and Native, of all castes and classes—infants, children, invalids—subsist for long periods together, and these the most helpless and voiceless. Time after time is disease being specially traced to this produce ; lives are being sacrificed every day, and outcries arise from every station in India against the present *regimé.* The time is therefore ripe for legislation. All European countries have laws in force against adulteration of food, and the last were passed by the Senate of the United States in 1892, under the name of the "Pure Food Bill." That India also needs a Pure Food Act, at least so far as dairy produce is concerned, is the object of this paper. I propose to discuss it under four several heads.

I. Milk and its Preparations.—The preparations from milk are very numerous—some dozen direct products and numberless indirect—and their liability to contamination and adulteration naturally very easy. The preparations are best studied in the following table :—

Dairy Produce : Preparation and Uses.

Products.	Preparation.	Uses.
I. Whole Milk (*Nirala dúdh, Nikhalis dúdh*).	Supplied by cows, buffaloes, goats, sheep, asses, camels, mares. Sold fresh or boiled (by *Hulwais*.)	Sweetmeats very various. Puddings and custards, sauces and soups, ice creams. Fermented drinks : Koumiss, kephir, and others.
II. Condensed Milk (*Khoa*)	(1.) By condensation in vacuum pans (Europe.) (2.) By prolonged boiling while stirring in open *kurahis* (by *Hulwais*.)	Eaten as such. Confectionery, puddings, &c., substitute for milk and cream.
III. Cream (*Milai*). IV. Skimmed Milk (Creamed Milk, *Nikhala hua dúdh Kream ka dúdh*).	(1.) By skimming from unboiled milk (old European method.) (2.) By skimming from boiled milk (Devonshire or clotted cream, the *milai* of the bazaars.) (3.) By separator machinery process direct from fresh milk (modern European method.)	For manufacturing butter, culinary and confectionery cream, cheese. Sold as pure whole milk. Culinary and confectionery for making *khoa* for cheeses, feeding animals.
V. Cream Cheese ...	(1.) By curdling milk with sour *dahi* or butter-milk. ... (2.) By boiling milk with *dahi*, &c. (see *chena* or curds.) (3.) From *dahi* alone.	Real cream cheese. False cream cheese. Dacca cheese, Abbottabad or Punjaub cheese.
VI. Butter (*Makhun*). VII. Butter Milk (*Mutha Ghol*, dussee)— (*a*) Sweet butter milk. (*b*) Sour butter milk.	(1). By addition of *dahi* to boiled milk, 12—24 hours before churning (Indian method). (2). By ripening of cream alone (European method). (3). By churning whey when cheese is made (whey butter). (4). By direct churning from fresh milk. (5). By special combined separating and churning machinery (unknown in India).	Making ghee, culinary and confectionery. As a nourishing drink for men, calves, cows, pigs, poultry, &c. The fresh milk butter-milk (*maha dúdh*), sold commonly for pure whole milk, especially when boiled.
VIII. *Ghee* (Clarified Butter, French Butter).	By boiling ordinary butter till it becomes granular ...	Culinary purposes (next to milk, the most extensively used in India). Confectionery. Anointing head and body. As medicine (old ghee).
IX. *Dahi*, or Tyre (Coagulated sour boiled milk).	By addition of *dahi*, or sour butter-milk to boiled milk. (*Bacillus dahi*) of Mr. Hankin.	Dressing for the hair (by Sikhs). Used beaten up as false cream for culinary purposes ; ice cream ; confectionery ; cream cheese.
X. Curds (*Chena*). XI Whey (*Chena ka pani*)	(1). By addition to boiling milk of salt, sour *dahi*, vinegar, tamarind, or other acid. (2). By rennet or fruit of certain plant (making clotted milk or junket).	Culinary and confectionery whey butter.
XII. Cheeses (*Paneer*) ...	(1). By curdling whole milk with rennet or fruit of certain plant ; plain, salted, colored. Do. do. moulded and salted ... Do. skimmed milk or half skim, half whole milk.	Cheddar, Chester, &c. Gorgonzola, &c. Cheap Cheeses.

II. IS DISEASE COMMUNICABLE BY DAIRY PRODUCE?—This is a question that has now been well threshed out as well in the United Kingdom as on the Continent, in America, and in this country, and much valuable information has accrued from several important recent investigations.

(1). *Bacteriology.*—From the labors of Pasteur, Koch, Klein and others much light has been thrown on the bacteriology of milk products. Schenk * describes 25 pathogenic and saprophytic micro-organisms, but several others can be added. Milk may be contaminated either during milking or in the subsequent manipulation, and may exhale an odour owing to the substances so acquired (*Bacillus fœtidus lactis*), or become slimy or stringy (*Bacillus lactis viscosus*), or take on a bitter or an acid (*B. dahü*, Hankin), sweetish, putrid taste (*Bacillus fœtidus lactis*), or its color may turn yellow, blue (*B. cyanogenus*), or red (*B. lactis erythrogenes*). Moreover various pathogenic micro-organisms (parasitic) may be imparted to milk from the diseased animal furnishing it. Many dangerous organisms, however, may exist in it or in its products without exciting notice.

(2). *Diseases.*—The following 13 diseases have been discovered to be due to milk contaminated, either directly or indirectly, by specific germs, *viz.* :—

Tuberculosis (1).
Typhoid or Enteric Fever (2).
Cholera (3).
Diarrhœa (Interitis) (4).
Vomiting and Purging (Ptomaine poisoning) (5).
Gastritis (6).
Dyspepsia (acidity, &c.) (7).
Stomatitis and Apthœ (8).
Diphtheria (9).
Scarlatina (10).
Foot and mouth disease (Eczema epizotica) (11).
Peculiar febrile symptoms (12.)
Peculiar "milk sickness" (vomiting, collapse, &c., from cows suffering from the "trembles.") (13)

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* Schenk's Manual of Bacteriology.

(1). See, among recent contributions, Discussions on Tuberculosis; Transactions International Congress, Hygiene and Demography, London, 1891, Vol. II; Papers by Burdon-Sanderson (p. 192), and McFadyean and Sims Woodhead (p. 197). The Society of Medical Officers of Health at their annual meeting at Newcastle, in August, 1893, approved of the memorandum on the Prevention of Consumption drawn up by the North-Western branch of their Society, which, among other practical precautions, affirms: (*a*) "Mother who is suffering from consumption should on no account be allowed to suckle her child. (*b*) All cow's milk, *especially that for the use of children*, should be thoroughly boiled before being drunk. There is no sort of legitimate doubt that tuberculosis in children is largely caused by the use of unboiled milk from consumptive cows. There is no truth in the belief that boiled milk loses its strength or is less easily digestible." (See Priestley's article "Sanitary Science," *in Medical Annual*, 1894). Dr. Ernst and three Veterinary Surgeons, Peters, Jackson, and Frothingham (Massachusetts, U. S.) found at least 31·5% of cows had Koch's tubercle bacilli in their milk. *American Journal of Med. Sciences*: See *Indian Medical Gazette*, December 1889.

(2) See an interesting and important account of an outbreak of cholera and enteric on board ship "Ardenclutha" in March, 1887, investigated by Dr. Simpson, Health Officer, Calcutta, in Journal of Calcutta Health Society, 1888. (*b*) Surgeon Manifold, 4th B. C., 1887-88, and Brigade Surgeon Hamilton: Hamilton's "Enteric Fever in India," p. 21. (*c*) An account by a correspondent in *Pioneer* of 22nd July 1891 of an epidemic in 1884-85, at Largs (3 or 400 cases), Ayrshire, Scotland, where the county Sanitary Officer traced it to a dairy with fouled cattle water-supply. (*d*) Mr. Hankin's reports on two outbreaks in the East Surrey Regiment, Agra, traced to *Dahii—Indian Medical Gazette*, August 1894, and *Civil and Military Gazette*, 1894. (*e*) The Renfrewshire epidemic: see "Ice Cream and Typhoid," *Brit. Med. Journal*, October 1894, p. 829. (*f*) Dr. Michæl Taylor, Penrith, was the first to trace enteric to milk in 1857. Since then (*g*) Dr. Ernest Hart (*Ed. B. Med. Journal*) has tabulated 50 outbreaks with 3,500 cases due to milk, up to the year 1881. (*h*) In 1889 Professor Davies, Netley, added 19 more such epidemics, with 400 cases. (*i*) Dr. Russel, Health Officer, Glasgow, investigated eight of these epidemics. (Lecture to Glasgow and West of Scotland Agricultural Discussion Society) See *Indian Medical Gazette*, 'Dairy Farms and Health,' August 1890.

(3) Dr. C. N. Macnamara's cases in Chowringhee, Calcutta:—*Indian Medical Gazette*, March 1872, (see also Article "Cholera," pp 374 and 406; Davidson's Hygiene and Diseases of Warm Climates, 1893). (*b*) Dr. D. D Cunningham, Part V, Scientific Memoirs by Medical Officers, India; Editorial on "Cholera and Milk," *Indian Medical Gazette*, March 1890. (*c*) Cholera Report on outbreak at Dacca, where two European Officers died from contaminated milk. Dr. Gregg, Sanitary Commissioner for Bengal, 7th July 1891. (*d*) On Bacilli of Cholera Typhoid, and Tuberculosis in milk, butter, and cheese: Dr. Heim, German Imperial Health Department. (*Lancet*, September 14th, 1889). (*e*) An interesting article on flies and cholera diffusion through milk, Surgeon Major Macræ, with report by Drs. Haffkine and Simpson—*Indian Medical Gazette*, November 1894.

(4) See references to investigations by Booker and Jeffries in America, and Escherich, Bagnisky and Stadthagen in Germany. "Infection of Meat and Milk," by Dr. Vaughan, Michigan, United States; International Congress Hygiene, &c, 1891, Vol. III, p. 126. (*b*) "Summer Diarrhœa and sterilisation of milk," Bagnisky, Epitome; Medicine, *B. Med. Journal*, 17th November 1894.

(5) Due to Deneke's Spirillum tyrogenum and others; Vaughan's tyrotoxicon or cheese poison. Report of Michigan State Board of Health; also *Analyst*, November and December 1886. (*b*) Parke's Hygiene. (*c*) Lyon's Medical Jurisprudence, India. (*d*) Taylor's Medical Jurisprudence 1872. (*e*) Mr. Smee's experiments: Editorial, *Indian Medical Gazette*, August 1890, page 239.

(6). Mosler, Virchow's Archive, 1868, quoted by Parkes.

(7). Hesling, Virchow's Archive; Army Medical Report, Hygiene: quoted by Parkes. Common belief in India; especially buffalo milk.

(8). Fagan, *Brit. Med. Journal*, 1869; Mosler and others also (Parkes). (*b*). Epidemic Apthous Fever: Dr. Robinson, Dover, International Congress Hygiene, 1891, Vol. III., p. 170.

(9). In 1881 Mr. E. Hart tabulated seven Epidemics of Diphtheria due to milk. (*b*) XVI m. Report, Medical Officer, Local Government Board, 1885-1886: Mr. Powers. (*c*) Further Report on Etiology of Diphtheria; Report, Medical Officer, Local Government Board, 1889-90, p. 167. (*d*) See "Infectious Udder Diseases of the cow in relation to Epidemic Diseases in the human subject," by Dr. Klein, International Congress Hygiene, 1891, Vol. III, p. 145 et seq. (*e*) See Klein's paper, Proceedings, Royal Society, Vol. 48.

(10). Dr. Russel, Glasgow; see Editorial "Dairy Farms and Health," *Indian Medical Gazette*, August 1890. (*b*) In 1881, E. Hart tabulated 15 Epidemics of Scarlet Fever traced to milk: International Medical Congress, 1881, Vol. IV. (*c*) "Infectious Udder Diseases of the Cow, &c." International Medical Congress, 1891, Vol. III, p. 130; confirmed by Dr. Bostock Hill, Health Officer, Birmingham; Discussion, same, p. 153. Infection is denied by Drs. Crookshank, McFadyean, Ostertag, Brown and others; same. (*d*) Bexley, Epidemic 1892, Dr. Sutherland, "Dairyman," April 1892.

(11). See references to Drs. McBride, Gooding, Hislop, Latham, and Briscoe, Parkes' Hygiene. (*b*) Professor Brown remarks: "Milk is contaminated with specific diseases, such as pleuro-pneumonia, tuberculosis, and foot and mouth disease" International Congress Hygiene, 1891, Vol. III, p. 168. (*c*) Russel, *Indian Medical Gazette*, August 1890.

(12). Sanitary Record, Vol. II., quoted by Parkes: the Aberdeen Outbreak, 1881.

(13). Hirsch has collected many instances. See other references. Parkes: due to cattle eating Rhus toxicodendron (poison oak).

To these may very probably be added several others, including dysentery, malarial fevers,[*] smallpox, rinderpest,[*] pleuro-pneumonia[†], actinomycosis, and anthrax[*] due to direct contamination or adulteration with befouled water, etc. Milk may also be contaminated by inflammatory products in nearly every disease to which the cow is subject. Professor Brown cites an instance where, in a case of septic mammitis, a milker actually milked into a pail a quarter of the contents of the udder, from which came nothing but pus, under the impression that it was peculiarly rich milk.[‡]

Certain medicines given to milch animals, as tartar emetic, arsenic, &c., or poisonous plants eaten by them (*euphorbium*, *colchicum*, *rododendron*) impart to milk characteristic poisonous properties. The injurious effects, especially now in India, from feeding on brewery grains, distillery refuse, and sewage grass, require to be recollected. Cattle fed on the former two get alcoholised, and after a factitious increase of poor milk, dry up or die early. Unnatural food of any kind, so universal in India, would alter odour and flavour of milk; but not necessarily, and hence the greater danger, although such milk would not keep well. Milk again is frequently—in India commonly—contaminated by milking with dirty hands and from unclean udders, by dipping fingers into the milking vessel to moisten the teats - and by "droppings." Dr. Edmunds puts enteric down to the last (*B. Med. Journal*, 22nd September 1894.) Storage or carriage in metallic vessels, or foul pails, particularly uncleansable earthenware (ghurras, handies, &c.) is a *very* fruitful source; as is exposure in dirty, dusty, open street shops, kitchens, &c.

II. THE CONDITION OF COW-BYRES AND NATIVE DAIRIES, uninfluenced by law or regulation of any kind, is not only deplorable but disgraceful. Such deliberate neglect is but a natural outcome of the *laissez faire* or *kuch purwa ne* system in vogue throughout India. In 1886 Dr. Kenneth McLeod, I. M. S., of Calcutta, in a lecture on this subject before the Calcutta Health Society, called attention to the revolting condition of the squalid *gwalla barees* of the city and suburbs; and the Society appealed to the Government of Bengal for legislative help But I doubt if anything came of it. Quite recently the Calcutta Press—in common with that of other parts of India—have been again discussing the question. As doctors are believed to exaggerate, some independent civil and lay testimony may prove more satisfactory.

A writer in the *Indian Daily News* says: "In our midst we have perhaps the foulest dairies or byres in the world, regulated by no rules of cleanliness, care, or humanity. They are nurseries prepared and ready for the germ which is to spread an epidemic of disease and death amongst us. I would ask any one with an enquiring turn of mind, and one who is not particular about smells or filth, to come with me and visit some of the largest byres in the northern division of the town. In amongst the bye-lanes you have many establishments, some containing up to 150 cows. Huddled together in tiled sheds, these unfortunate creatures are not allowed more than standing room, and are only saved from suffocation by the many holes in the roof, which, if they save them from immediate death, let in the weather. Over and over again I counted forty tethered in two rows in a room forty feet long, and with enough depth of space to allow the forefeet to touch the *gumla* that does duty for a manger, whilst the hindlegs rested on the edge of a drain about eight inches broad by eight inches deep. In some of the smaller sheds I counted six animals in ten feet, but then they had the advantage of no drain." Dr. Armstrong, Medical Officer of Health, Newcastle-on-Tyne, advocates 800 cubic feet as the *minimum* for each cow in a cow house. (Int. Cong. Hyg., 1891, Vol. III, p. 169): "It was or is impossible that the animals could lie down together; they have to take it in turns. The drain is for the purpose of receiving the droppings, and is placed so close to the heels that no labor is required for cleaning. The refuse is carried or washed through into a shallow pit immediately outside the shed, and often mixes with human excrement drained into the same place from sources only too palpable to sight and smell. This mixture percolates through the sodden light soil, and as the wells which supply the drinking water for the cows are only a few feet away, you can imagine what must be the nature of the contamination and the miracle which is exercised every day in warding off communicable disease from milk consumers. The milch cows' lot in the hands of the Calcutta wholesale milk supplier is not a happy one. Tethered in sheds from the moment they are bought, they never leave again for pasturage, water, or any other purpose; they are closely confined, fed on husks of gram and grain, chaff, and occasionally a little oil cake; rendered barren by a most inhuman process of cruelty which is inflicted twice a day or oftener to make them render up their milk freely; and then after patient endurance of these agonies for six months, which is mercifully not often extended to the year, they are led forth to the butcher's knife, and so from 30,000 to 50,000 cows are led annually to the shambles instead of contributing to the increase and purity of the milk supply." (*Indian Daily News*, September 1894).

Now, what is this barren resulting inhuman process alluded to? It is known as "*phooka*" (blowing,) and consists of blowing air into the vagina with the mouth by means of a bamboo tube six inches long. This causes immediate bearing-down pains which makes the cow yield up all her milk without the aid of her calf. A previous application of salt to the tongue, followed by a free drink, causes the secretion of a comparatively abundant, thin watery milk of low specific gravity. This is quite a common practice in Calcutta. A Superintendent of Dairies in the Punjab tells me : " A bamboo tube is not invariably used ; the mouth is also applied direct to the vagina held in position and compressed by the hands. Sometimes only air is blown in, at others a little salt is put into the mouth, to which is then added some milk, and this mixture is injected. (The agony endured can be imagined). Again the tail of the animal operated on is forced into the vagina and left there for some little time, often for half an hour, if the animal prove obstinate. Also, the *gowala* often inserts his own hand into this organ, as far as it will go, and, keeping it there, pats the animal on the back with the disengaged hand. After a few minutes the other is withdrawn, and the *gowala* at once sits down and draws all the milk he can. It can well be imagined how the intense agony caused by these inhuman practices causes the poor animal to let down her milk. The practice is *common all over the country*. It is said these practices continued in renders the animal eventually barren. I should think so." The Calcutta Society for Prevention of Cruelty to Animals has made strenuous efforts and representations to Government to allow them to stop this outrage to all feelings of humanity by arresting all detected cases. Government, however, refuses to extend the powers of the Society for this purpose." (*Indian Daily News*).

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[*] Pepper's System of Medicine, Philadelphia, 1885, Vol. I, p. 590.

[†] Husband's Forensic Medicine includes under one head Rinder-pest, Anthrax, Pleuro-pneumonia, and foot and mouth disease. (*b*) In Middlesborough Pneumonia Epidémic (490 deaths), reported by Ballard, infected food was proved by Klein to be the medium; then why not milk? Professor Brown says it is. International Congress Hygiene, 1891, Vol. III, pp. 112 and 168.

[‡] International Congress Hygiene, 1891, Vol. III, p. 167.

The special independent reporter of the *Civil and Military Gazette* was deputed last year to visit the cow sheds and dairies in the city of Lahore. Here is what he says : " I had often heard doctors and veterinary surgeons speak of the unutterable filth of all the arrangements connected with the milk supply in Lahore city and bazar. I had heard, too, that the Punjab Secretariat considered that the views of doctors and veterinary surgeons were too highly colored * * * but I must confess, after what I have seen, that if the professional reports were too highly colored they must have been the most extraordinary official documents ever penned. To do justice to the subject, it appears to me that one would have to write one's remarks *in ink that smells*. * * * It was just daylight when I arrived at the first place of interest in connection with my object. This was a collection of mud huts inhabited by Gujars surrounding a small open space tenanted at that moment by apparently forty milch kine and buffaloes. The odour of the place was fetid. The ground was slippery with filth. It was traversed by little miniature drains which slowly oozed a thick liquid of the color of chocolate. There were some very old earthenware vessels full of very dirty water, in which, *with the aid of cow dung*, the *lotahs* for the milk were being 'cleansed.' I watched the milking operations, and saw a man with his hand scoop away a lot of filth from the place where he desired to squat, and then with the same hand he commenced to milk the buffalo next to him. I have often noticed a queer, dark sediment in bazaar milk. I now know where one component of that sediment is derived, for after the man had been milking for a little while his hand was washed quite clean. I then proceeded to the next place where milch kine are collected outside the city walls. There had been heavy rain overnight, and all the filth that washing could remove was gone. * * * But Oh, the condition of those cows, crowded together in rows ! Their feet were sunk in the 'splodgy' ground, which was not mud but strata of old filth, permeated with moisture throughout, and in places presenting every shade of decomposition, green, purple, and black." He saw at least one cow buffalo with elephantiasis (?) in all four legs and one emaciated cow suffering from rinderpest, both yielding up their moiety of milk. " One buffalo cow had been lying down. The under surface of the body, and especially her udder, were dripping with filth. It never occurred to the milker that any cleansing operation was needed before he proceeded to add her milk to the store. " And he goes on to describe the usual over-crowded, loathsome dens, alleys, and dairy huts, with befouled drinking water wells, etc. " Out of this noisome hole issues the milk for young European children and invalids." (" Tell me where is typhoid bred "? By our special reporter, *Civil and Military Gazette*, 3rd June 1893.)

III. FODDER : HOW COWS ARE FED IN INDIA.—Many good people decline to believe that milch cattle are fed on *highly objectionable and unnatural fodder*. But it is a fact nevertheless, and should be impressed on the Government. Ordinary garbage is the least objectionable of such " food. " It is notorious that cattle all over India are fed on excreta-soaked litter cast out from horse stables. This particularly in cantonments where cavalry and artillery are stationed. In Calcutta, I believe it is brought from syces, and I have myself, in a mofussil station, more than once witnessed cattle feeding on this in preference to grass probably from usage. Brigade Surgeon Hamilton says : " I have known the riding schools to be covered with horse litter from the stables in the day, and next morning it had disappeared, eaten by the very cows and buffaloes that supplied the hospital and barracks with milk. " * But this is not all. When pushed for fodder, or even without any scarcity, under the impression that such conduces to increase or richness of milk, the *goala* does not scruple to deliberately feed his animals on actual *horse dung*, if from a gram-fed animal the better. I have myself more than once caught *goalas* (in Beluchistan) in the act of collecting excrement from mules, and discovered traces of the same in the feeding *gumlas*. But early morning or night is the feeding time. † In the "*goala mundis*" up country, buffaloes particularly are so fed on the sly.

But worse still, if possible, for there is even a " lower hell " in *goala* feeding, it should be widely known that owing to neglect and deliberate training Indian village milch cattle are often natural "foul-feeders," like sheep, dogs and pigs, wild and domesticated.[*] Some ten years ago, a local Lahore print (the *Punjab Advertiser*, I think) called attention to the general practice of Gujars deliberately grazing their kine and buffaloes on particular fields in the vicinity of the suburbs and large villages (noted for cholera too) of that city. In a cantonment in Assam, I had the misfortune to discover that cows and other animals forced their way into the military latrines, so that we had to have a sort of fortification with guarded entrances erected to protect them. Such indeed are the animals that provide us meat and dairy produce in this country.

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* Hamilton's Enteric Fever in India, p. 21.

† The local Native Magistrate fined them Rs 5 on two separate occasions ! !

It is thus very apparent that very close and constant inspection is absolutely necessary; and that no greater mistake could ever be made than to believe that if the consumer sees his *goala's* cow milked before his door that he ensures either a pure or a safe supply. The *goala*, moreover, can cheat under the very eyes of the onlooker. The clever twirl, upside down, of a partially-filled *lota* of water, to prove it is empty, is a common dodge; and Dr. Hamilton detected a man literally "milking" water into his *lotah* from a small leathern bag (*mussuk*) concealed in his clothes, and this under the eyes of the orderly set to watch him.

It ought also to be specially borne in mind that "*cheap*" and "*nasty*" are *convertible terms in dairy produce.* I wish to emphasise this fact that it is *absolutely impossible* to get good, pure, wholesome dairy produce at the *present prevailing rates.* Generally speaking, they are *starvation rates* on which no *goala* can live without fraud. They ought most certainly to be raised from one-third to one-half higher.

IV. ADULTERATIONS.—Time only permits of the enumeration of the principal or commoner adulterants:—

(1). *Milk,*—Foul tank or other water (as much as 20—25 per cent is common in Calcutta); skimmed milk; churned fresh milk; these separately or mixed with fresh milk;[†] milk of various animals mixed; chalk (coloring); flour or arrowroot (color and consistence).

(2). *Cream,*—*Dahi*; *Khoa* (condensed milk); Linseed (? boiled in milk yields a jelly); cotton seed oil (?).

(3). *Butter,*—Water (often foul) or butter-milk well intermixed (30—50 per cent common); curds; plantain (fat); suet (lard); extra salt; potato and other starches (?); oleo-margarine, butterine, etc.[‡]

(4). *Ghee,*—Walnut oil; cotton-seed oil (?); mowaseed oil (*Bassia latifolia*); fat (Dumba sheeptail-fat common in Punjab); lard; potato, flour, and other starches; raisins (to preserve it, Punjab and Frontier); gram powdered ("basun" or "suthoo").

I have now, I think, made out a very strong case for legislative interference in the interests of both Natives and Europeans. The Municipal Act should be amended and strengthened, and rigid inspections and regulations enforced on all the points I have indicated. And as the country at large is not yet ripe for such measures, I beg to earnestly urge that the amended Adulteration and Dairy Produce sections of the Municipal Act, or a new separate *Pure Food Act*, be extended to all cantonments, large railway stations, and all municipal towns, and perhaps Sub-Divisional head quarters of districts. All Inspectors to be properly qualified, and be Europeans in large towns and cantonments. Another thing I would beg to urge on Government would be the direct encouragement, in every possible way, of *European private enterprise in Dairy farming*, in preference to any Commissariat monopoly of such, as otherwise the civil population can never hope to enjoy the untold advantages of modern dairying.

Meanwhile, let everybody who values his life *boil his goala's milk.* This is known as "Pasteurisation." Water boils at 212° F.; milk at 213·5°F.[*] All infectious germs are thus destroyed, the digestibility of casein apparently not affected, and the keeping power of the milk improved and prolonged.

DISCUSSION.

The President of the section said that Dr. O'Gorman's paper had well described the insanitary conditions in which the milk-supply is conducted in this country, and has shown the necessity for some reform in this direction. Till every municipal town is provided with Health Officers and Analysts, little can be done beyond amending municipal byelaws, *e.g.*, that all milk vendors should be licensed, and, as Dr. O'Gorman suggests, be made to keep a list of their customers for inspection. As the milk-supply of a town is usually drawn from villages within ten or fifteen miles of the place, no mere inspection of dairies, etc., within municipal limits will suffice. In regard to the milk supplied to British troops, it was absurd that, while the men were supplied with good milk from cantonment dairy farms, the Quartermaster of a regiment should be allowed to pass milk for the married quarters supplied by native bazaar vendors.

With respect to the remarks made about the use of cow-dung as a plaster for the walls of native houses, we should remember that many cattle diseases are conveyed to animals by the excreta. He was also convinced that cholera could thus be communicated to man.

With regard to Dr. Dutta's contention that there should be a standard for milk of buffaloes as well as for Indian cow's milk: this, of course, was necessary, but any one who has watched the prosecutions in England for supplying bad milk, cannot fail to have noticed that Magistrates do not recognise standards, and it was easy to provide experts who will show that differences may be expected in the quality of milk due to difference in forage, temperature, season, &c. A rigid standard like that for water cannot be upheld for milk. A large series of analyses of Indian milk from all parts of the country is much wanted.

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[*] This no doubt is due to want of salt. Goats and others eat bones for this purpose.

[†] The lactometer test still applied in hospitals, is useless, as the modern *goala* knows how to "correct" the specific gravity of his skimmed milk with water and sugar.

[‡] A sort of "butter" has even been manufactured in London from grease found in Thames mud!

[*] Dr. J. Edmunds, *British Medical Journal*, 22nd September 1894.

FOOD ADULTERATION.

BY JOGENDRA NATH DATTA, B.A., M.B.,
Calcutta.

Early history.—The early history of the subject of adulteration of food-stuffs, in India, is involved, like all others, in mystery. It has been said, and very justly too, that commerce must develope before adulteration commences. In the pre-historic ages, India had, no doubt, a little commerce, but that commerce, in the proper sense of the term, did then exist is very doubtful. However, we do find that the practice of adulteration appears to have been in vogue, even in the good old days of *Manu*, the great Lawgiver of the Hindus.

The Hindu *Sastras* have laid down rules for the regulation of the habits and customs of the people from their cradle to the grave. In the zeal for the moral and religious well-being of the people, they have not overlooked to enjoin the observance of the fundamental doctrines for the preservation of health, which they regard as the basis of all action, but which modern hygiene claims for its own.

Though understanding fully the effects of various food-stuffs on the maintenance of health, yet we do not find any record which the adulteration of such food-stuffs entail, and the reason for this is not very far to seek. The fertility of the soil, the exuberance of production of all the necessities of life, with light labour coupled with no export trade, are exponents to explain that there has been no necessity or even temptation to adulterate such food-stuffs. The literature on the subject, either in the Hindu period or in the days of the Mahomedan period, is a mere blank. With the immense increase in the export trade during the English rule, adulteration of food-stuffs has cropped up, and every year it is increasing at a fearful rate.

Now, as regards food-stuffs and their adulterants, the first and foremost for consideration comes milk. It forms an universal article of food, as it contains all the elements necessary for body nutrition. It forms the chief food for the infant population as well as for invalids and sick people. The nobility and gentry use it daily as part of their food. In the villages of Bengal the rural population also use it largely : and even the poorest classes, whenever their means allow it. Both the cow's milk and buffalo milk are used by the people. In Lower Bengal, cow's milk is principally used ; goat's milk and ass's milk being used in some cases by delicate infants and invalids. In the North-West Provinces and Behar, buffalo milk is chiefly used by all classes of the community.

It must be admitted that a large proportion of milk produced is used up in making *butter*, *ghee*, *kheer*, *channa*, *dhoee* (curd), etc., so extensively used by the people, but still the consumption of milk as such is large enough. It is much to be regretted that in cities and towns not a single sample of milk can be had in the markets which at all approaches to genuine milk, unless one gets the cow milked for him.

Now, the chief adulterant is water, and the milkmen think it their prerogative to mix water with milk and thus to sell it. The extent of adulteration ranges generally from 20 to 60 per cent., and in some cases only the colour of the milk having been preserved. The effect of such adulteration in some cases is disastrous. Unscrupulous as the milkmen are, they do not hesitate to mix any kind of water which they can command, or get easily, no matter whether it is from a pond, tank, or well, receiving all kinds of garbage and sewage matters from surrounding lands, as is generally the case with tanks in this country. An average of fifty samples of tank-water examined by me will give an idea of the condition of the tanks in the *bustees* of Calcutta, which very nearly represents the tanks in the Mofussil, whence the milk is chiefly brought into town.

	Chlorine, per Million.	Total Ammonia per Million. (Free and Albuminoid.)
50 Samples	272·5	19·2

A notable instance of the evil effects of this practice was recorded by Dr. W. J. Simpson, Health Officer of Calcutta, in one of his reports, in which an outbreak of cholera in a ship was traced to the contamination of milk with water from a tank infected with cholera dejecta. Similar mishaps took place once amongst the prisoners in the Alipur Jail, and amongst the soldiers in the Station Hospital, Bhowanipur. Happy it is for the people of this country that they take their milk always boiled. It is only the European and those who take milk in the raw state who are chiefly liable to be thus affected. Diphtheria, diarrhœa, dysentery, and typhoid fever have also been traced to this cause. One of the most fruitful causes of mortality amongst infants, *viz.*, the infantile liver, has also been attributed to the faulty milk.

The next adulterant is *batasa*, or molasses in the form of semi-circular cakes. This is used to make up the dilution. In some cases lactometers are used by the people to detect the addition of water, and to elude such detection this practice was resorted to Extraction of fat or cream is also very largely practised. Buffalo milk being very rich in fat, a portion of the fat may easily be extracted without detection. It has been said that chalk and arrowroot are frequent adulterants, but, excepting on a single occasion, I have not been able to find any in any of the numerous samples I have had opportunities to examine in the Calcutta Municipal Laboratory. The various other things, such as borax, salicylic acid, carbonate of soda and salt, etc., used in other countries either as preservatives of milk, or for some other purpose, need not concern us, as they are never made use of in this country.

The next article for consideration is *butter*. Unlike the practice in European countries, butter is prepared in this country by first curdling the milk with some acid, generally sour milk, and churning it up, removing the cream and washing it thoroughly in water. It is stored up in large earthen jars, covered up with a layer of common salt—a layer of mould grows on the top. It is in this state sent from one place to another. There are two varieties of butter in use : (1) that made from cow's milk ; (2) that from buffalo milk. The chief manufacturing centres of butter from which the Calcutta market is supped are Dinapore, Uttura and Ghatal. The butter from cow's milk is very dear and fetches a high price. The other variety is largely imported from the North-West Provinces for daily consumption. It is largely in demand by the European and Eurasian communities ; the Hindus and Mahomedans use it as well, but not so largely as the European cummunities. But the great bulk of the produce goes in for the preparation of *ghee*, which is largely used and by all classes of the inhabitants of this country.

As to the adulterants of butter, the chief are beef fat, lard, water, and sometimes pulp of plantains, and annatto (*Bixa Orellana*) (*Beng. Natkan*). Excepting water, the others are rare adulterants. As to water generally there is from 14 to 16 per cent., but in adulterated cases it ranges up to 75 per cent. It would startle any analyst to learn this fact, but one could easily satisfy himself on the point if he goes to a butter vendor and sees him working up his butter with water for retail sale.

The next food-stuff for consideration is *ghee*, or butter clarified. The use of this article amongst the inhabitants of this country is very large. In the preparation of various sweetmeats, so largely consumed by the people and in the preparation even of their ordinary meals, *ghee* forms an essential ingredient. Like butter there are two varieties of *ghee :* that made from butter from cow's milk, called *gawa* ; and that made from butter from buffalo milk, called *vysa*. The first is the only kind used by the Hindus for their sacrificial and ceremonial rites.

The chief manufacturing centres of *ghee* from which the Calcutta market is supplied are Chandrakona, Monghyr, and Bhadua. The price ranges very high, from Rs. 30 to 38 per maund. Such being the case it induces the fraudulent tradesmen to adulterate it with cheaper acticles to get the largest profit. As to the adulterants of *ghee* I beg leave to refer to that valuable work, Dr. Watt's "Economic Products of India."

Mustard-oil.—The use of this article is even more general than any other already mentioned. Almost all classes of the people, from the richest to the poorest, use it in some shape or other in the preparation of their various food-stuffs. In fact this supplies in part the fatty substances necessary for a standard diet. The consumption of this article is very large, and stands in equal footing with other accessories of food-stuffs, such as *ghee* and common salt. It is not astonishing, therefore, that other substances cheaper than mustard seed and containing a larger percentage of oily matter are mixed with it fraudulently in the preparation of the article which finds so ready and extensive a sale. (For a detailed description see Dr. Watt's "Economic Products of India.")

It is hopeless for one, unless he be an expert, to distinguish the one variety of mustard from another, but generally we do recognize two varieties : the black and the white. Both these are used in the preparation of the oil, the black ones preponderating largely, and the oil from the mixed seeds is in common use in the country. The oil is expressed from the seeds simply by pressure. The seeds are slightly smeared with water, in order to develope the volatile oil which is not present ready formed in the seeds ; but on which depends the market value of the article produced. To the presence of the volatile oil and other active principles, the stimulating and other physiological properties of the oil depend, and the oil loses its beneficial and stomachic properties in proportion as it is admixed with other oily substances deficient in these qualities

The chief adulterants are :—Sorgoja oil, ground-nut oil (*Arachies hypogia*), poppy oil, *til* or sesamum oil, *sajina* juice (*Morigna pterygosperma*) and chilis (*Capsicum frutescens*). Generally these substances are mixed with the seeds and compressed together to extract the oil. In some cases the oil is separately mixed with other oils. As to sorgoja, the manufacturers say, that a certain proportion of this is absolutely necessary for the complete extraction of the oil from the seeds, so that one should be on his guard in giving his opinion in case he detects this admixture in the oil.

I shall next deal with other food-stuffs seriatim, mentioning the various articles used as their adulterants :—

Barley	...	*Sutte* powder, wheat flour, arrowroot and potato starches.
Wheat flour	...	Rice flour and arrowroot.
Arrowroot	...	*Sutte* powder (*Curcuma angustifolia*).
Honey	...	Uncrystallizable residue from cane sugar.
Common salt	...	Sometimes refuse from saltpetre is mixed, but very rarely.
Kheer (*Mawa*)	...	Arrowroot and cane-sugar.
Lime-juice	...	Solution of citric acid scented with lemon oil or essence of lemon.
Tea	...	Exhausted tea leaves.

I have refrained from dealing with various wines and drinks as they are not indigenous products of the country.

These are a few of the articles in common use that are generally found to be adulterated ; but in the case of compound articles, there being no definite composition for these, adulteration is practised to a very large extent, and the adulterants are also very numerous : thus the *metai* shops in Calcutta have actually become a nuisance. The concensus of opinion of the medical practitioners of the town is that over fifty per cent. of the people of Calcutta suffer from dyspepsia and liver complaints from this cause alone. Although of late Calcutta presents vast improvements as regards other branches of sanitation, the health of the people is getting undermined from want of proper legal control over the food-stuffs. It behoves the Health Officer and the Government to step in now and prevent the insidious evil that is undermining the health of the people.

It is necessary, in order to deal with any question of adulteration and to check it effectively, that standards of such articles as are generally found to be adulterated should be fixed; but in India, owing to the neglect hitherto shown to this most important subject, and owing to there being no organised body of analytical chemists, this most important point, as to the fixing of standards for various articles of food-stuffs liable to be adulterated, has been left out; so that each analyst depends on his own analysis, and nobody knows which standard he adopts in giving his opinion as to the quality of a sample submitted to him for opinion. In this way there is every likelihood of a conflict of opinion as to the quality of a given sample between the analysts themselves. It is only in the case of milk, as shown in the following table, that we find the results of analyses recorded by eminent analysts in this country :—

—	DR. STEVENSON AND DR. SIMPSON.		MR. CRIPPER.		DR. MACNAMARA.
	Cow.	Buffalo.	Cow.	Buffalo.	Cow.
Water ...	85 33	81·12	86·18	82·6	86·93
Total solids ...	14·67	18 88	13 8	17·38	12·27
Solids not fat ...	9·87	10·86	8·9	9·9	8·94
Casein ...	4·01	4·72	3·84	4·11	4·82
Fat ...	4·8	8·02	4·88	7·5	3·33
Sugar ...	5·11	53·8	4·4	4·95	4·17
Ash ..	0·75	0·76	0·7	0·8	0·75
Specific gravity	1032·6	1033·3	1027·6 to 1030·18	1028·2	..

But as regards other food stuffs, difficulties beset the pathway, as there are no records of analyses of such food stuffs, and one must depend entirely on his own analyses and to fix his own standard. I desire to record the results of analyses, conducted in the Municipal Laboratory of Calcutta by Dr. S. B. Ghose and myself, of various samples of *butter*, *ghee*, *milk* and *mustard oil*, so that these may be considered in fixing the standards for such articles which I intend to propose hereafter, and which I would ask this assembly to settle and to adopt.

BUTTER.	DINAPORE.			UTTURA (SO CALLED)			GHATAL.		
	Min.	Max.	Aver.	Min.	Max.	Aver.	Min.	Max.	Aver.
Water ..	13·8	16·5	15·36	15·01	17·8	16·1	28·1	33·29	
Casein and salt	0·2	1·07	0·49	·15	2·3	0·86	1·7	2·0	
Fat ..	81·15	85·9	84·23	80·4	84·8	83 01	65·01	71·9	

GHEE.	BUFFALO.						COW.		
	Min.	Max.	Aver.				Min.	Max.	Aver.
Soluble volatile acids by Reichert and Woolney's in. c. c.	30·5	39·3	34·5	..	..	..	24 0	27·0	24·5

MILK.	Min.	Max.	Aver.				Min.	Max.	Aver.
Water ..	80·5	83·64	81·5				85·2	88·1	86·23
Total solids ..	16 36	19·5	18·7	..	..	..	11·9	14·8	12·84
Solids not Fat	10·46	11·5	10·75	..	..	..	8·9	9·98	9·1
Casein ..	4·4	4·96	4·66	..	..	..	4·32	4·5	4·4
Fat ..	7·0	9 5	8.57	..	..	..	3·14	4·9	3·34
Sugar ..	4·8	5·0	4·86	..	..	..	4.3	4·8	4·4
Ash ..	0·7	0·8	0·746	..	..	..	0·7	0·79	0·75
Sp. gr. ..	10·31	10·35	..	..	..	..	..	..	..

MUSTARD OIL ... Sp. gr. ... 913—915
Hübl. 1. ... 97—100
Sap. Equi. ... 280—285

Sulphuric acid reaction—Immediate green coloration followed by brownish discoloration.

I append here the standards for milk adopted by the various State Boards of Health, in other countries, and by the Society of Public Analysts in England.

—	Water.	Total solids.	Non-fatty solids.	Fat.	Ash.	Sp.gr.
	p. c.	p. c.	p. c.	p. c.	p. c.	
Society of Public Analysts ..	88·5 Not more than	11·5 Not less than	9·0	2·5	0·7	1030
State of New York ..	88·0	12·0	90·	3·0	..	..
„ Massachusets	87·0	13·0	..	..	..	..
„ New Jersey	88·0	12·0	..	..	..	..
Paris ..	88·5	11·5	..	27·	..	..

Now taking these as our guide we can for our purposes adopt for this country, at least for Bengal, a standard which is a fair one, so that the public will not have to stand at a discount in getting their food supplies either from the manufacturers or from the retail vendors. I therefore propose that the following standards for the different articles be adopted :—

CONSTITUENTS.	MILK.		BUTTER.
	Cow's.	Buffalo's.	
Water ..	88·5	83·5	Water,...... from 13 to 10 p.c.
Total solids ..	11·5	16·5	Casein and Salt „ 1 to 2 p.c.
Non-fatty solids ..	8·5	10·5	Fat „ 18 to 86 p.c.
Fat ..	3·0	6·0	
Ash ..	0·7	0·7	

—	GHEE.		MUSTARD OIL.
	Cow's.	Buffalo's.	
Sp. gr. ..	911-912	911-913	Sp. gr. .. 913·915
Sol. Vol. acids in terms of deci-Normal soda by R. & W's. method ...	24 c. c.	30·5 c. c.	Hubl I. .. 97-100 p.c. Sap. Eui .. 280-285.
Melting point ..	34°-35°5C.	34°-36°C.	H_2SO_4 Reaction—Immediate green coloration, followed by brownish discoloration.

As regards existing laws relating to adulteration it may be noted that, unlike the history of other countries in Europe and America, whose histories are well preserved, we do not find either in the old days of the Hindus any further regulation (cf. ch. 9 *Manu Sanhita*) or in the days of the Mahomedan conquest and rule, any record of any regulations regarding adulteration of food stuffs in use ; nor even in the present English rule, before the year 1860, the year of enactment of the celebrated Indian Penal Code. But even the sections 272 and 273 of the Code,* dealing with adulterated food and drinks, remained practically as dead letters, even up to the present day, owing to technical difficulties in their application. In the year 1886, owing to the earnest solicitations of both the Hindu and Mahomedan communities, Act III (B. C.) was passed and prosecutions under this Act were instituted for the first time for selling adulterated *ghee.* Since then, the Act II, B. C. of 1888, was passed, incorporating the former Law. Sec. 364 of the present Act provides that "no person shall sell to the prejudice of the purchaser any article of food which is not of the nature, substance or quality of the article demanded by such purchaser, under a penalty not exceeding Rs. 100 for the first offence and not exceeding Rs. 500 for any offence after a conviction for a first offence," and so forth.

The section is comprehensive enough, though there is room for its amendment ; but as it is applicable only to places within the jurisdiction of the Corporation of Calcutta, it has a limited value.

Practically then for India there is no Act similar to the English Act of 1879, 38 and 39 Vict., Ch. 63, for the sale of food and drugs.

It may then be said that the law relating to the subject of food stuffs is in its infancy yet and will take some time to develope and to work ; but adulteration of almost all commodities has since become so prevalent that something must be done to protect the public against the nefarious trade of the unscrupulous tradesmen, whose chief object is to make wealth, though it is at the cost of the health of the community.

I have already shown that the existing laws are either insufficient or inapplicable to meet the requirements in the present state of things. Even in Calcutta, the only place where the law has been in operation for some years, it will be seen from the following remarks of the Health Officer in his Annual Report for 1891, that the condition of the food supply of Calcutta has not improved materially and he adduced some reasons for it. He remarked, "though compared with previous years, the adulteration of *ghee* has slightly abated, yet the adulteration of other articles of food was found to be very common. The indifference of the public, the inadequate provisions of the law on the subject, and the clemency of the Magistrates in dealing with the delinquents, are the main factors which work against any satisfactory improvements being effected in the quality of food stuffs sold in Calcutta." In the working of the Sec. 364 of Act II. B. C. of 1888, the following legal difficulties have arisen, thus : in a case of prosecution for adulterating milk with water, the Honorary Magistrate, before whom the case was heard, held that as the Food Inspector did not ask for *pure* milk, the case cannot stand. So the case for the prosecution was dismissed. In a *ghee* case a similar plea was taken by the Honorary Magistrate, and that case was dismissed too. Another curious case also happened, in which an Honorary Magistrate held that, notwithstanding the fact that the sample of *ghee* brought by the Food Inspector for analysis was adulterated with other fat to the extent of 20 per cent., the sample should still be called *ghee*, so that the vendor has not acted otherwise than in conformity with Sec. 364 of Act II. B. C. of 1888, under which the prosecution was instituted so the prosecution failed ; but this case on appeal to the High Court, the Judges, after setting aside the judgment of the lower Court, convicted the vendor and fined him. In one case for a prosecution for adulterating milk, the summons even was not granted by the Honorary Magistrate, on the plea that no case had been made out, though the milk was adulterated with water to the extent of 60 per cent., the Magistrate remarking that such practice was common in this country, so it cannot be called a case of adulteration.

Thus, it will be seen that the object of the law was defeated in the instances cited above, for want of clear definitions of some of the terms of the Act, but as it is almost impossible to define the whole lot of food stuffs to obviate such difficulties, I would beg to propose that the following clauses, or clauses similar to them, should be inserted in the Act II. B. C. of 1888, under sec. 364 :—

(*a*) No person shall mix any substance to reduce or lower or injuriously affect the quality or strength of any article of food, or abstract, either wholly or in part, any valuable constituent thereof, or substitute, either wholly or in part, any inferior or cheaper substance with it, with intention to sell the same or exposing them for sale, as food, under a penalty in each case not exceeding Rs. 50 for the first offence, and Rs. 100 for a subsequent offence, with forfeiture of the articles so mixed, abstracted or substituted.

(*b*) No person shall sell any compound article of food which is not of the nature or substance to be specified in the Vernacular of the district, on the label to be affixed, in each of the articles to be so sold, under a penalty not exceeding Rs. 20. and for non-labelling Rs. 5 for the first offence and Rs. 20 for each subsequent offence, in each case.

(*c*) There shall be appointed a Board or Committee consisting of the Chemical Examiner to Government, the Health Officer of the Town (or if he be not an analyst, the Municipal Analyst) and two independent public analysts to set forth definitions and exceptions, and to fix limits and standards of quality and purity of various articles of food.

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*Sec. 272, I. P. C.—Whoever adulterates any article of food or drink, so as to make such article noxious as food or drink, intending to sell such article as food or drink, or knowing it to be likely that the same will be sold as food or drink, shall be punished with imprisonment of either description, for a term which may extend to six months, or with fine which may extend to one thousand rupees, or with both.

Sec. 273—Deals with the sale of noxious food or drink.

With these few additions, the Sections 364, 365, 366 and 367 of Act II. B. C. of 1888 may be looked upon as fairly complete to deal with the question of adulteration or unwholesome admixture of food stuffs, and I would earnestly solicit that the Government should adopt the same and extend the operation of these sections to other Municipalities in the Provinces of Bengal, and to other Presidencies as well.

DISCUSSION.

Jogendra Nath Datta said that the composition of cow's and buffalo's milk differed much, and therefore they must not be compared by the same standard. Butter, too, from different places, differed in composition very much; he had, therefore, proposed a standard in the hope that all manufacturing centres should be made to produce butter of nearly the same composition. The European standards are far higher than those obtainable in India.

P. W. O'Gorman (Midnapore) agreed with Dr. Datta as to the variations in the analyses of milk and butter; they vary in different countries and in different parts of a country, as well as according to seasons and nature of food. There were too numerous and varied breeds of cattle in India. Mr. Howell lately had compared the milk from various parts of India, and considered that the milk of a well-fed Indian cow was equal to that of the best Jersey milk in England. But the milk of ordinary animals in India gave very inferior results. Hence the necessity of a special standard for India.

N. Rudolf (Saran) heartily agreed with Dr. Datta's remarks on the adulteration of food, but suggested the desirability of using the standards of purity laid down by the Society of Analysts.

Sundarimohan Dass (Calcutta) said that the above papers had showed the necessity for the protection by enactment of food and milk. He said milk was generally credited with much influence in producing infantile liver disease, but he would ask what ingredient of milk or what adulteration? Other disease, such as cholera, had been traced to milk. He suggested that dairy-keepers should keep registers of their customers and suppliers which should be open to the inspection of sanitary officers, and that dairy-keepers should be made to notify any infectious disease among their cattle.

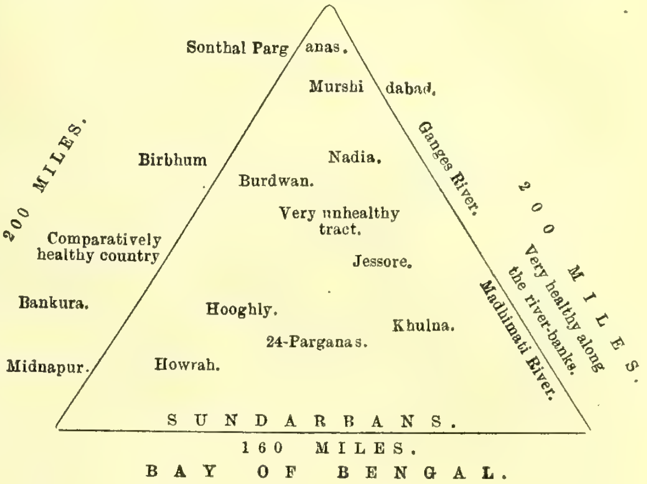
Foot-note.—The resolutions given above in Dr. Jogendra Nath Datta's paper were then put to the sectional meeting and passed unanimously.

UNHEALTHY TRACTS IN BENGAL.

BY W. H. GREGG, D.P.H.,

Brigade-Surgeon Lieut.-Colonel, I. M. S.

With the exception, perhaps, of the tract of country lying at the base of the Himalaya mountains known as the Terai, or the special region of malaria, the most unhealthy part of Bengal is the triangular piece of country which lies in the hollow, which is bounded by the high banks of the rivers Ganges and Madhimati on the north and east, the elevated laterite soil districts of the Sonthal Parganas, Birbhum, Bankura and Midnapore on the west, and the tidal swamps of the Sundarbans, which form the upper northern boundary of the Bay of Bengal, on the south. The area of this triangle, which is clearly shown in the following rough sketch, is from 15,000 to 16,000 square miles; it measures about 200 miles long and is about 160 miles broad at its base, comprising the districts of Murshidabad, Nadia, Burdwan, Hooghly, Jessore, Khulna, Howrah and the 24-Parganas, and containing a population of over eleven millions:—



2. No part of this low-lying tract of country has an elevation of more that 60 to 70 feet above mean sea level; in the 24-Parganas, Howrah and Khulna, the greater portion of the land is only from 10 to 20 feet high. Drainage is, therefore, an extremely difficult matter, and to this, in addition to a water-supply polluted with malarial poison, must be attributed the great unhealthiness of the tract. As special attention was lately drawn to the subject, in connection with the excessive mortality prevailing in certain portions of this part of Bengal, I spent the month of August last in making a laborious inspection of the locality, with the following results.

3. The most unhealthy portions of this exceptionally unhealthy tract are comprised within the registering circles of Asanpur, Manullabazar, Shahanagar, Gorabazar and Daulatbazar in Murshidabad, Bangaon in Jessore, and Hanskali in Nadia, in all of which the death-rate was above 50 per mille in 1893, which may be taken as an average year, and it will be seen from the figures in the following table that malarial fever was responsible for the greater portion of this mortality:—

Names of Registering Circles.	Death-rates in 1893 from						
	Cholera.	Small-pox.	Fever.	Dysentery and diarrhœa	Injury.	Other causes.	Total.
1	2	3	4	5	6	7	8
Asanpur ...	5·03	...	51·44	·29	·29	6·22	63·29
Manullabazar ...	5·52	...	53·08	·24	1·20	1·68	61·73
Shahanagar ...	7·86	...	44·57	...	·44	4·64	57·53
Gorabazar ..	9·06	...	45·51	·08	·58	1·58	56·83
Daulatbazar ...	6·94	·02	39·13	·10	·36	4·25	51·13
Bangaon ...	·81	...	44·23	·01	·27	7·68	53·02
Hanskali ...	2·16	...	42·82	·08	·58	6·55	52·21
Average ...	5·34	·02	45·82	·11	·56	4·65	56·53

4. It may here be mentioned that this exceptionally unhealthy tract being, as already pointed out, exceedingly low-lying, it was found necessary by the inhabitants, in order to prevent total destruction of their rice crops during the heavy floods, which frequently occur from July to September, to raise bunds of earth, so as to divert the floods from the rice-fields to the adjoining rivers. Some of these bunds are of great antiquity, many of them having been constructed during the Muhammadan rule in Bengal. By the permission of the Collector of Murshidabad, I was enabled to examine some of the oldest records on the subject in his office, and in one instance I found allusion made to the repair of one of the principal bunds situated in the northern portion of the Murshidabad district. The letter in question was written on the 3 th September 1778 by Lieutenant Thomas Burges, Superintendent of the Poolbundy, to the Members of the Provincial Council of Revenue, Murshidabad.

5. Of the destructive characters of these floods I will give an instance: On the 11th September 1885 a great inundation occurred, when the river Jalinghi rose 29 feet above its lowest hot-weather level, breaching the embankment (Laltakuri) referred to in the last paragraph. A vast volume of water swept south-eastward across the centre of the Murshidabad and Nadia districts and the west of Jessore. It happened at the time that there were simultaneous freshets in both the Ganges and the Brahmaputra, and the waters of the former, banked up at Goalundo by the latter, were forced to find egress to the sea by the rivers of the Murshidabad and Nadia districts, which for several centuries have been silting up and were quite inadequate to carry such an immense volume of water as the Ganges was bringing down from Upper India. Some 5,000 square miles of country were thus flooded to a depth of 5—8 feet. The Eastern Bengal Railway was breached in three places and the mails had to be carried in steam-launches over a country which a few weeks before was dry land covered with a promising rice crop. The resultant distress amongst the people was for a time very great. In villages on any but high ground the mud walls of the houses crumbled away, and many cattle were drowned. The affected localities had hardly recovered from this great calamity when they were again in the autumn of 1890 overtaken by a precisely similar disaster, which for a second time destroyed the crops. The rivers this time rose a foot and a quarter higher than in 1885, the crops were entirely destroyed on 350 square miles of country, and the total rice outturn of the district was reduced by nearly one half. I mention these recurring disasters in order to show the natural disadvantages which the people of these tracts have to contend against owing to the physical formation of the land they live on.

6. One of the most remarkable results of my investigations in this unhealthy tract was the very noticeable difference in the health of the people living in different parts of it. Those who live on the comparatively high lands along the banks of the Ganges and on the extensive sand banks called *churs* which occur so frequently in the beds of large deltaic rivers are far stronger, healthier, and more robust than the people who inhabit the centre of the tract of country lying between the Ganges and the comparatively healthy laterite lands on the west; and again there is a remarkable difference in health even in the low-lying land between the jail and asylum population which is located on drained sites no higher than the surrounding country, and the civil population, *i.e.*, the villagers, who live in the same locality, but on undrained sites. The latter are saturated with malaria. They have a dull and weary look, and are ill with a disease which, though it causes no pain, saps all the springs of their energy and joy. On the other hand, in striking contrast, the jail and asylum population in the same locality is healthy, deaths from malarial fever being conspicuous by their comparative absence. This favourable result is undoubtedly due, not only to the well-drained sites on which the jails and asylums are situated and to proper medical treatment, but also, and especially to the good drinking water with which the prisoners and inmates of asylums are supplied. The figures in the following table showing the average daily population and the death-rate from malarial fevers in the principal jails and asylums in the unhealthy tract of country under consideration contrast in a very remarkable manner with the figures in column 4 of the table I have given in paragraph 3 showing the death-rate among the general population in the same tract. Among the latter it will be seen that the average fever death-rate in 1893 was 45·82 per mille, while in jails and asylums it was only 1·3 per mille :—

NAMES OF JAILS.	Daily average strength.	Number of deaths per annum from malarial fever.
1	2	3
Murshidabad Jail ...	222	...
„ Lunatic Asylum	204	...
Nadia Jail	160	...
Jessore „	302	2
Khulna „	34	...
Burdwan „	192	...
Hughli „	347	2
Jails in the 24-Parganas ...	1,740	...
	1,262	...
	39	2
Total ...	4,502	6

7. In order to investigate this striking contrast further, and to see what difference, if any, social conditions of life made in the health of the people, I made an examination into the prevalence of enlarged spleen, and that peculiar swollen and tender appearance of the gums which so closely resembles the conditions which occur in cases of true scurvy. The general result of the examination showed that, though these conditions appeared to be closely connected with malnutrition,

they were, so far as I could make out, in no way the result of want of sufficient food, including vegetables, but seemed rather to be due to the effect of a system saturated with malarial poison. In all the cases I examined—and they were a great many—the gums were more or less swollen, dark and spongy, receding in almost every instance and exposing the teeth which were frequently loose. I observed no ulceration or sloughs on any other part of the body. The general appearance was the same in all cases, *viz.*, a dry skin, a sallow and unhealthy look, lustreless eyes, unhealthy yellowish tongues and a general appearance of languor and anæmia. I examined separately three distinct sections of the community, *viz.*, (1) the educated and presumably well-to-do (*bhadra loks*) ; (2) the village watchmen (chaukidars), who are for the most part recruited from among the most healthy local male population ; and (3) the ordinary villagers, including adults, children and infants. As types of the educated classes, I examined, with the help of the local Assistant Surgeons, the students of the colleges of Berhampore and Krishnagar, and of the schools situated in various parts of the area in question, and found that the percentage of enlarged spleen and swollen gums among them were 17·48 and 22·57, respectively. Among the village watchmen it was 31·47 and 38·05, respectively. Among the ordinary village population there was considerable variation, the highest percentage being in the village of Tarackpur close to Berhampore, where I found 81·2 per cent. of the people suffering from enlarged spleens and 41·6 per cent. from swollen gums. In this village, which is a large one, only 6·2 per cent. of the inhabitants are over 50 years of age. The average percentage, however, of enlarged spleen and swollen gums among the ordinary villages was about 53·64 and 35·12, respectively.

8. Examining next into the effect of geographical conditions, I found among the people inhabiting the comparatively high lands along the Ganges and the sand banks already alluded to an almost entire absence of enlarged spleen and swollen gums. Here, as already stated in paragraph 6 of this paper, the people are as a consequence remarkably strong, healthy and robust, although they live under most peculiar conditions.

When I visited the sand banks in August last, *viz.*, during the rainy season, I found that in one place between 15 to 20 square miles of homestead land had been entirely swept away. I saw boats containing the thatched roofs and mat walls of the dismantled cottages of the peasants ; in the same boats were the men, women and children with their domestic animals and household utensils all on their way to other sand banks on which they had been promised a footing.

But more remarkable still is the difference already alluded to in paragraph 6 in the health of the people living under favourable and unfavourable circumstances amidst the same swampy surroundings, *viz.*, the inmates of jails and lunatic asylums as compared with the ordinary village population. The percentage of enlarged spleen and swollen gums among the former is very small.

9. Thus we see that in the same tract of country the greatest unhealthiness prevails amongst the unfortunate people who inhabit the undrained and badly watered villages, and that a remarkable immunity is enjoyed by their more fortunate brethren who reside along the banks of rivers and on drained sites which are also provided with a good water-supply.

10. The large percentage of persons suffering from swollen, dark and spongy gums directed my attention to the food usually consumed by the people inhabiting these unhealthy tracts. I therefore considered it desirable to inspect and weigh the food ordinarily used by the people. I visited a large number of villages and got the villagers themselves to bring the food which I carefully weighed ; much interest was taken by the people in these weighments ; the different articles used at the three meals of the day were placed in separate groups and then weighed, the amount of each kind of food used was within the limits shown in the following table :—

Table showing the food used by the villagers inhabiting the unhealthy tracts.

	Ounces.	
7 to 8 A.M.—		
Rice (cold)	10 —11	
Vegetables (roasted) ...	6 — 7	
Salt	$\frac{1}{2}$	
Tamarind	$\frac{1}{4}$	
Oil (mustard) ...	$\frac{1}{4}$	(sometimes).
Onions or chillies ...	$\frac{1}{4}$	
11 to 12 NOON—		
Rice (fresh cooked) ...	15 —17	
Peas	2 — 6	
Vegetables	11 —14	
Fish	2 — 6	
Salt	$\frac{1}{2}$	
Oil (mustard) ...	$\frac{1}{2}$— 1	
Tamarind	$\frac{1}{2}$— $\frac{1}{3}$	
Chillies or onions and spices	$\frac{1}{4}$— 1	
8 to 9 P. M.—		
Rice (freshcooked) ...	15 —17	
Peas	2 —4$\frac{1}{4}$	
Vegetables	11 —14	
Fish	2 — 6	
Salt	$\frac{1}{2}$	
Oil (mustard)... ...	$\frac{1}{2}$— 1	
Tamarind	$\frac{1}{2}$— $\frac{3}{4}$	
Chillies or onions and spices	$\frac{1}{4}$— 1	

Allowance must be made for the extremely succulent character of the vegetables used. I found that when milk and curds were used, a less quantity of peas and fish were taken.

If the amounts given in the above table are compared with the food tables given in Parkes' Hygiene, it will be seen that the people of these tracts have a sufficient and complete diet, and that neither the quantity nor quality of the food used by the peasants can in any way be held responsible for the terribly unhealthy state in which the greater portion of them are.

11. In this connection I wish to mention as an instance of cause and effect the very close relation there

is between obstructed surface drainage and bad drinking water, which plays such an important part in the health of the people. This is strikingly illustrated in the registering circle of Hanskhali which lies between the Krishnagar circle on the west and the Echamuttee river on the east. A number of bunds which were raised to protect the land from being flooded bound it at its northern part; the circle is divided diagonally into nearly four equal portions by the high bunded road passing the Bogoola railway station to Krishnagar running from north-west to south-east, and the high banks of the Chornee river passing from north-east to south-west.

The northern and eastern portions of this circle are especially blocked by bunds, and consequently malarial fever is most prevalent in those parts. In the north the death-rate from this cause in 1893 was 70·9 per mille, and in the east 58·7, the average for the whole circle being 52·21 per mille. In the village of Hanskhali, which is situated in the north of this circle, there were in 1893, 73 births and 94 deaths in a population of 583, which is equivalent to a death-rate of 161·2 per mille. In many other villages also which I visited in the northern and eastern portions of this circle the death-rate from fever is very high, most of the mortality occurring from August to December. In the adjoining circle of Bangaon in the Jessore district the natural surface drainage is also seriously obstructed, and the result shows itself in a very high death-rate from fever. In the Ghatbaor village of this circle it was 81·2 per mille in 1893, in Jeypore it was 72·1, in Chowbana 87·7, in Chinili 93·3, in Mataria 111·4, and in Jeala 184·8. Some of these villages can only be approached during the rainy season by wading knee-deep through the marshes which surround them.

12. I could give a great many more examples of the excessive prevalence of malaria in these parts, but I think I have said enough of the great unhealthiness which prevails, and of the urgent necessity there is for sanitary improvement. The practical question is, what can be done to improve the health of these people? The late Raja Degamber Mitter, with whose opinion I agree, pointed out that "the cause of fever, whether in its endemic or epidemic form, was in the village itself and amidst human habitations, not in the rice-fields in its neighbourhood." And Professor von Pettenkofer, of Munich, has said the same thing. In his own words "the dwelling ground of the people has much more to do with the origin of the disease than has the surrounding district or land." "There can be no doubt as to the abnormal humidity of the subsoil being at the root of malaria. It is not the subsoil of the jheels and paddy fields that is to be looked to for its proximate and exciting cause, but that of the fever-stricken villages themselves." "What is required is not large expenditure of money, but a careful, constant and minute attention to the drainage of the villages." As a rule "Bengal villages are several feet higher than the adjoining country, and unless naturally or artificially obstructed there is on that account a peculiar facility for their through drainage" which should be taken advantage of. Not only should the village sites themselves be drained, but a scheme of surface drainage is necessary by which the whole of the unhealthy tract of country which we are considering may be relieved of its surplus water. This might be done in an inexpensive and at the same time very effectual manner. Most residents in Bengal are familiar with the numerous and indiscriminate insanitary roadside hollows which have been formed by excavations for earth to make or repair road embankments. Instead of the wasteful and unsystematic manner in which this is done at present, it should in future be the rule that earth required for this purpose should be dug out from the side of the road in such a manner as to form a regular drain which could be used, not only to carry away the surplus water from the surrounding fields, but also to allow fresh water from the Ganges and other rivers to flow through the unhealthy tracts; the annual cleansing of the drains and the removal of silt would furnish material for the repairs of the roads at the same time. Thus a double purpose would be served by the same labour and at a minimum of expense. The District Board should be made responsible for this.

13. To improve the health of the people living in these unhealthy tracts it is also necessary to provide them with good drinking water, which at present, owing to obstructed drainage, is for the most part obtained from marshes, tanks and wells which are impregnated with the germs of malarial poison. It is a fact that good drinking water is scarcely obtainable in this tract of country, and the inhabitants clearly recognise this fact. In all the villages I inspected I was told by the villagers, who are extremely intelligent, that if they could only be supplied with good water their health would be vastly improved. At present many of them are too weak and languid from the effects of malaria to cultivate their lands effectually, and have not even the energy to remove the rank vegetation which accumulates in the neighbourhood of their houses and which they know is one of the exciting causes of malaria. It is, however, impossible to improve the drinking water-supply until an effectual system of drainage is provided to carry off the surplus and impure surface water.

14. As regards medicinal remedies, the success which has attended the treatment of prisoners in jails and the inmates of lunatic asylums in these unhealthy tracts naturally suggests that similar means may, as far as possible, be placed within the reach of the ordinary villager. With this object in view, the Government recently inaugurated a scheme for the sale of pice packets of quinine through the medium of village post offices which is working with marked and gratifying success. Last year nearly 1,500lbs. of quinine were distributed in this way, and as the object of the scheme gets more widely known there is everyreas on to expect that a much larger quantity will be applied for.

15. With regard to the consumption of opium, I noticed in most of the unhealthy places I have visited in these unhealthy tracts that many people seem to have considerable faith, and not without cause, in the medi-

cinal properties of this drug, which is acknowledged, especially in the case of elderly persons, to be a sedative to the nervous irritability produced by malarial poison. In Murshidabad, where I believe malaria prevails to a greater extent than in any other district in Bengal, opium is largely used, the consumption being about 1 seer 8 chitaks to every 1,000 persons, and in the registering circles of Asanpur and Manullabazar, which are the most unhealthy in the district, it is more largely consumed than in any other registering circle. In the district of Nadia the consumption in 1893-94 was ·762 of a seer per mille, and in Jessore ·49 of a seer per mille.

WATER-LOGGING OF THE VILLAGES ALONG THE COURSE OF THE WESTERN JUMNA CANAL AND ITS EFFECTS.

BY H. J. DYSON, F.R.C.S.,
Surgeon-Captain, I. M. S.

Previous to the year 1868, reports were rife that the villages irrigated by the Western Jumna Canal were being severely water-logged, and that, in consequence, the population was dying out, and the land falling out of cultivation. So grave were these rumours that, in the year 1868, Dr. Adam Taylor, then Civil Surgeon of Delhi, was deputed to inspect certain selected irrigated villages regarding their health, at the same time he had orders also to inspect a group of unirrigated *bárání* villages as a standard of comparison. The results of his examination you will find on the printed tables A to D before you. He used the existence of an enlarged spleen as evidence of the ill-health of the people.

In consequence of his report large portions of the Western Jumna Canal were re-aligned and drainage schemes were put in force. In the year 1892 the Punjab Government was anxious to ascertain whether these measures had effected any material improvement in the condition of the inhabitants of the canal area. In consequence I was directed by the Government to carry out an enquiry in the same villages as those inspected by Dr. Taylor, and on the same lines, the results of which enquiry, as contrasted with his, will be found on the printed lists before you.

For convenience of examination the villages were grouped in circles named A to I.

The villages from A to F are all irrigated by the canal where it has been re-aligned or drainage works have been or are being carried out.

Circle I, situated in the Hissár district, also consists of irrigated villages, but no re-alignment has taken place in this area; Circle G consists of unirrigated riverine villages lying near the river Jumna; and Circle H consists of unirrigated or *bárání* villages. We possess, therefore, three distinct standards for comparison: irrigated villages, riverine villages, and unirrigated villages.

By reference to the printed lists before you, you will see that an improvement has taken place in all the circles of villages where the canal has been re-aligned or surface drainage carried out, with the exception of one, namely F. The improvement is most marked in the case of Circles A and D, both of which are in the Karnál district. The town of Karnál used to be a military cantonment, but had to be abandoned on account of the severe unhealthiness due to malaria.

In Circle F, improvements carried out, dating, as they do, only two or three years back, have not as yet had time to materially benefit health.

Circle I consists of villages lying along the Hansi Branch of the Western Jumna Canal. This canal was first constructed by the Mughal Kings, and since it runs in the bed of the natural drainage line of the country, has naturally water-logged this area severely with the necessary sequel of a high spleen percentage; drainage schemes and syphons under the canal to allow the escape of storm water are now under construction. In addition to this, another factor, which undoubtedly largely increased the unhealthiness of the area, *viz.*, rice-growing, has ceased to exist, owing to the voluntary recognition of its danger by the inhabitants, and an improvement in health may be confidently looked for.

Circle G, situated in the Delhi Division, is a particularly interesting one, for we see in it as severe ill-health, the result of water-logging produced by natural cause, as may be observed in any irrigated area.

The villages forming the circle lie near the river Jumna, and some are yearly swamped by it. The increase of the spleen average is significantly coincident with the proximity of the village to the river, thus—

	Yards.	
Manáoli, distant from the river ...	400	= 57·5
Jakhouli	1,360	= 25·0
Khewarah	28,000	= 12 5
Báni	34,000	= 7 5
Chirasmi	33,200	= 7·5

The last, Circle H, is of great importance, for it affords a standard for comparison of the difference of health in unirrigated villages situated on high level ground, which are not water-logged, and low-lying irrigated canal villages.

The whole of the irrigation of the villages in this circle is carried out with water derived from wells, whose general water level is from 60 to 80 feet below the surface. This is a marked contrast to the condition of the wells in the canal area.

In canal villages, the general water level in the weather ranges from 5 to 10 feet; equally marked is the difference in the spleen average of 3·33 as compared with averages in canal villages in Circles B and F of 41·11 and 40·00.

In carrying out these investigations the spleen test was used; in each village twenty adults and twenty children were examined for the existence of enlarged spleens. In large towns fifty adults and fifty children were examined in each quarter. The adults were grouped in classes, thus :—

Brahmins and Faqirs.
Hindu cultivators.
Mussalman cultivators.
Baniahs or shop-keepers.
Artizans.
Menials.

The size of the spleen was also registered under the following heads :—

1. Very large—extending across the median line.
2. Large—extending up to the median line.
3. Medium of the five classes.
4. Considerably enlarged.
5. Slightly enlarged, *i.e.*, could be felt under the ribs.

Dr. Dempster was the first person to select, in the year 1845, the existence of an enlargement of the spleen as the indicator of the amount of malarial disease existing in the locality, and Dr. Taylor and myself also followed his practice.

Enlargement of the spleen is a disease which is fortunately so placed that it can be detected with certainty and extreme facility, by the touch, and it cannot be either feigned on concealed, and returns compiled from observation of its prevalence are records of solid and substantial facts, and not abstruse conjecture on theoretical conclusions. Of course all attacks of fever do not necessarily produce enlarged spleen, but some do, and it is fair to consider that the number doing so will be proportionate to the whole.

Had this test not been applied, it is difficult to understand how any reliable information could have been obtained on the health of the people. It was often a matter of surprise to find by the spleen test "a slightly" or "considerably enlarged spleen" in persons whose outward appearance gave no indication of its existence.

This test is of immense value when drainage schemes are carried out in connection with any town or area. For, if before the drainage scheme is carried out, the spleen average is taken, and then again after an interval of ten, fifteen or twenty years, most accurate and reliable evidence can be obtained as to whether the people have benefited by the drainage or not. In cases also where new canals or their distributaries are about to be constructed, this test could always be used with advantage, for it affords accurate data for future examinations.

When making a spleen examination, great care was exercised to take only those passing to and fro about the place ; and all persons obviously sick, brought up in the hopes of obtaining treatment, were rejected, in order that the absolute amount of sickness should be gauged as correctly as possible, and everything likely to render the average greater than the actual state of the case should be excluded.

Though the re-alignment of the canal has done much to improve the health of the population, yet the system of surface and deep drainage has also greatly contributed to this improvement. The Western Jumna Canal area is now lined with shallow surface drains connecting one village *jhil* or pond with another and ending in deep subsoil drains. All deep and large village ponds are being drained so that they only contain sufficient water for the use of the cattle during the hot weather and no more. Large areas of ground which used to be occupied by sheets of water are now dry and brought under cultivation. So much so is this the case, that keen sportsmen declare that the canal area which used to be famous for its duck and snipe shooting is now being steadily ruined.

A typical instance of the great improvement produced by drainage may be noted in the case of Mehmudpur, in the Rohtak district. Of this village Dr. Taylor writes : "Take Mehmudpur, here 52 5 per cent. shows an amount of malarial disease, the causes of which can be appreciated at a glance ; a huge swamp filled with alligators and water-fowl runs to the walls of the village ; the water in the wells is not a foot below the surface ; great complaints of sickness were made."

This village has been thoroughly drained since the swamp has disappeared, and its place is now occupied by crops, and the spleen percentage has dropped from 52·5 to 22·5. Numerous other such instances could be cited, but time will not allow of it.

Water-logging may be due to several causes. In the canal villages it is generally due to proximity to the canal or its numerous distributaries, to excessive and unnecessary irrigation, or to the canal and its branches obstructing the natural drainage channels of the neighbourhood, thus causing the formation of *jhil* and marshy swamps. Water-logging is, however, also caused by low-lying villages on the banks of a river being swamped by an overflow from the river itself, as in the case of Circle G mentioned above.

The crops which most directly tend to produce water-logging are rice and sugarcane ; of these sugarcane is the worst, for rice is only about three months on the ground, while sugarcane needs seven months for its growth ; and both need large quantities of water.

The most striking feature in all water-logged villages is the high well water level. Along the Western Jumna Canal it is rare to find a well whose water level is more than fifteen feet below the surface ; five to ten feet being the general average even in the middle of the cold weather. During the rains the well water is so high in many canal villages that the villagers do not need to employ a rope to draw water, but merely dip their *lotas* into the well to obtain it.

That this high water level in the irrigated areas is due to the introduction of canal irrigation is shown by the fact that at many wells may be seen a deserted bullock-run of forty to sixty feet, which existed before the canals were constructed, the contents of which wells are now only five to ten feet from the surface.

I may mention here that in the rainy season of 1894 in Amritsar, so great was the pressure on the ground water that it actually poured out of the mouths of some of the wells on to the dry ground round them.

The effects of continuous water-logging are widespread, for they affect alike human beings, cattle, the soil, and the water-supply.

In the case of human beings, the first effect is shown by constant attacks of fever, usually of an intermittent type, though remittent is not uncommon. Subsequent to this come anæmia, scurvy, enlarged spleen, impotency and a high death-rate.

Its effects on the soil are also marked. If the water-logging is severe, a white efflorescent deposit of *reh* soon appears on the surface of the ground, and when this occurs over large areas, it imparts the appearance of a recent heavy fall of snow. In this deposit not a blade of grass can be seen, and *kikar* and *dhak* trees, stunted and puny, struggle for an existence, and the land necessarily falls out of cultivation.

The only tree which will grow at all freely in land damaged by *reh* is the *jal* (*Salvadora indica*), and its wood is so poor and so full of salt that it is unsaleable even as fuel; it absorbs saline matter readily, and its leaves have a saline taste. This tree might, therefore, be used when an attempt is being made to reclaim land destroyed by *reh.*

When the water-logging is not so severe, *reh* is found mixed in the soil, decreasing its fertility, so that only very inferior crops and harsh wiry grasses of low nutritive value are produced.

In the Punjab the cattle are largely dependant on such grass as they can find, but as the grass, owing to the presence of *reh* in the soil, contains very little nourishment, they are practically half-starved. Round such water-logged villages may be seen numbers of under-sized, emaciated cattle, with harsh staring coats. This ill-health of the cattle re-acts again on the inhabitants in two ways: *first*, the milk supply, which is one of the staple foods of the people, is curtailed in quantity and depreciated in quality; *secondly*, the plough bullocks, owing to their inferior physical condition, are less fit to carry on their work. In addition to this during the rainy season large numbers of cattle die from a peculiar swelling of the glands in the throat, accompanied by some salivation. Others succumb with dysenteric symptoms.

Again, owing to the presence of large quantities of *reh* in the soil, the water in the wells becomes brackish, or even unfit to drink, and dysentery is not uncommon in these villages. Unfortunately the people cannot be induced to drink the canal water, which is, as a rule, purer than the well water. This picture naturally refers to very severely water-logged villages only, and these fortunately are rare now, and tending to become less in number, but many gradations may be seen in the canal area.

One of the gravest evils, and one which is particularly felt by the Hindus, is the impotency so commonly found in water-logged villages, which results from the deterioration of health produced by constant attacks of fever and the presence of an enlarged spleen. The men in these villages freely acknowledge it, and beg for some medical remedy. As regards impotency in women, the subject is naturally a very delicate one, and any information on this point is very difficult to obtain. But if, however, the existence of sexual desire precludes the presence of impotency, then the women do not suffer in anything like the same degree as the men; for many were the complaints made in villages that, owing to the impotent condition of the men, the women showed a decided tendency to lead loose lives.

The birth and death-rates of these canal villages have been so recently registered, and are so faulty, that much reliance cannot be placed on them. Orders have, however, recently been issued by His Honor the Lieutenant-Governor, directing a careful registration in this area. But it is easy to see under the circumstances mentioned above that a high death-rate and a low birth-rate may be expected. The chief registered cause of death in the canal area is fever. But it is not fair to ascribe all the deaths registered as fever to that disease alone. The village *Hakim* is undoubtedly a potent factor in raising the death-rate. For when a man is suffering from fever, he is allowed no milk by the *Hakim*, for they say it is heating and produces cough and causes phlegm. As a general rule, only extremely small quantities of water, with a sufficiency of drugs and charms dissolved in water, are administered. Can it be a source of surprise that, under such a course of treatment, numbers succumb to an attack of fever? I have been called in frequently to see patients suffering from remittent fever of from nine to fifteen days standing, who during that period have received nothing in the shape of nourishment, except a few mouthfuls of water and drugs. The attitude of the generality of the people of the Punjab regarding quinine is curious. They maintain that it heats the body, and that the only remedy for this is to drink large quantities of milk; but as this is expensive, they frequently decline to use quinine. Recently, since quinine has been more appreciated, *Hakims* have begun to allow patients suffering from fever to drink milk if they have taken quinine, but not otherwise. It is a curious paradox that the heating of the body produced by taking quinine can only be assuaged by drinking milk, yet when the body is heated as a result of fever milk is contra-indicated.

Up to the present we have only considered the evils resulting from canal irrigation, but there is another side, and one which is thoroughly appreciated by the cultivator, and that is, his great improvement in monetary matters. The style of living and dress is far higher in irrigated than in unirrigated villages, and previous to the construction of the canal in many villages there did not exist a single masonry (*pukka*) house, where now masonry houses have become common. So great is the desire for irrigation that in Circle H of unirrigated villages, where the percentage is so low, and the health so good, the people are clamouring for an extension of the canal, though they are perfectly aware of the comparative ill-health in the canal villages.

1st.—The first and most important remedy to be carried out in the case of water-logged villages is a proper system of surface and deep drainage. If the latter cannot be accomplished, great benefit may be obtained by the former method by reducing the level and size of village ponds and of marshes.

2nd.—The sale or free distribution of quinine in the fever-stricken villages.—In the Punjab, till the people more thoroughly realize the value of quinine, it will probably have to be given free.

3rd.—Curtailing the amount of irrigation.—This will necessarily occur in the Western Jumna Canal, for a new and large distributary, called the Sirsa Branch, has recently been constructed, and large quantities of water which used to pass down the main line will now be directed down it; and in consequence the villagers living along the main line will be obliged to be more economical, and this will in all probability benefit their health.

4th.—In improving the condition of village wells.—I would here suggest a simple remedy in connection with them, that is, to cut sharply downwards and outwards the upper two layers of brick forming the top of the coping of the well. This will prevent people standing on the mouth of the well with dirty feet, from washing their clothes on the mouth, or resting dirty vessels on it. This system is automatic and does not require the presence of subordinate officials to ensure its proper working, thus avoiding any tendency to oppression on their part. In connection with this scheme there is one point to be remembered, either the mouth of the well must have on its internal circumference a circular rim of wood, or a forked stick with a small roller on it must be erected over the mouth of the well; the latter method is preferable. If these precautions are not taken, the people will complain, and naturally, that their well ropes are rapidly worn away by friction against the sharp edge of the coping. This form of well might be found useful in general village sanitation and is essentially simple.

In conclusion, after consideration of the various statements laid before you, I venture to think that there can be little or no doubt that the Western Jumna Canal undoubtedly exerted in former times a most baneful influence on the health of the population. It is, therefore, a matter for congratulation that this evil was recognized, and steps promptly taken to ameliorate the condition of the people. That the remedies applied have exerted a most beneficial effect can be recognized by a glance at the returns showing the results in the examinations of 1868 and 1893. The excellent results attained cannot fail to stimulate officers in charge of canal areas to renewed exertions, and I venture to think we may, with confidence, look forward to a time when, owing to the scientific alignment of canals and their distributaries, we shall find a healthy as well as a prosperous canal population.

A.

AREA.	Number of persons found with normal spleen.	Number of persons found with enlarged spleen.	Total number of persons examined.	Percentage found suffering with enlarged spleen.
A	291	109	400	27·25
B	212	148	360	41·11
C	202	78	280	27·86
D	344	96	440	21·82
E	942	378	1,320	23·64
F	216	144	360	40·00
G	152	48	200	24·00
H	232	8	240	3·33
I	432	168	600	28·00
Total ...	3,023	1,177	4,200	......

Classes of spleens used in the spleen test:—

1. Very large—extending across the medium line of the abdomen.
2. Large—extending up to the medium line.
3. Medium—the medium of the 5 classes.
4. Considerably enlarged—the medium of 3 and 5.
5. Slightly enlarged—can be felt under the ribs.

B.

Towns and villages in which the spleen percentage has markedly decreased since the year 1868.

	Dr. Taylor.	*Dr. Dyson.*	
Begampur	57 5	15 0	Circle A.
Karnál	41·25	15·0	
Sitáuli	75·0	42·5	Circle B.
Machri	70 0	55 0	
Batgáon	60·0	45·0	
Jajji	62·5	42·5	
Dharmgarh	55 0	15 0	Circle C.
Sitoundi ... — ...	42·5	30·0	
Joshi	40·0	27·5	Circle D.
Kurna	30·0	10·0	
Osri	77·5	22·5	
Bhalsi	62·5	20·0	
Asan Khurd	62·5	37 5	
Mehmudpur	52 5	22 5	Circle E.
Siwanka	37·5	22·5	
Pugthála	37 5	12·5	
Chamrara	62·5	37 5	
Mandi	52·5	27·5	
Palri	47·5	30·0	
Dohar	30·0	17·0	
Noultha	40·0	22·5	
Jataul	60·0	25·0	
Sisah	72·5	27·5	Circle I.

C.

Average percentages of persons found to be suffering from enlargement of spleen in villages inspected by both Dr. Taylor and Dr. Dyson.

AREA.		Percentages found by Dr. Taylor.	Percentages found by Dr. Dyson.	Increased percentages since 1868.	Diminished percentages since 1868.
Karnál District A Canal Villages	Re-aligned or drained.	45·75	27·25	...	18·50
Delhi District B Canal Villages		50·56	41·11	...	9·45
Karnál District C Canal Villages		35·50	27·86	...	7·64
Karnál District D Canal Villages		37·95	21·82	...	16·13
Delhi, Rohtak & Karnál E Canal Villages		34·29	28·64	...	5 65
Delhi & Rohtak F Canal Villages		30 28	40·00	9·72	...
Delhi G Riverine unirrigated		11·00	24·00	13·00	...
Rohtak H Unirrigated		4·17	3·33	...	0·84
Hissár I Hansi Canal not re-aligned ...		29 64	28·00	...	1·64

The following are the numbers on which the above ratios have been worked out :—

A.

Result of Dr. Taylor's examination.

AREA.	Number of persons found with normal spleen.	Number of persons found with enlarged spleen.	Total number of persons examined.	Percentage found suffering from enlarged spleen.
A	217	183	400	45 75
B	178	182	360	50 56
C	129	71	200	35·50
D	273	167	440	37·95
E	736	384	1,120	34·29
F	25	109	360	30·28
G	178	22	200	11·00
H	230	10	240	4·17
I	394	166	560	29·64
Total ...	2,586	1,294	3,880	......

SANITARY ARRANGEMENTS AT KUMBH FAIRS.

BY G. HUTCHESON, M.D.,

Brigade-Surgeon-Lieut.-Colonel, I. M. S.

THE Kumbh fairs, which take place at Hardwar and Allahabad at recurring intervals of twelve years, are the largest and most important religious festivals that take place in India or probably elsewhere. In view of the occurrence of grave epidemics of cholera at these great assemblages in the past, and the probability of the recurrence of such epidemics at the last Kumbh fair at Hardwar in 1891, and of the Kumbh fair at Allahabad this year, the duties and responsibilities of the Provincial Sanitary Authority were determined by the necessity of preventing the outbreak, or limiting, as far as practicable, the incidence of the disease.

2. Of Kumbh fairs at Hardwar previous to 1867 "very little remains on record, but that little is a record of disease and death:" so wrote the Sanitary Commissioner in describing the Kumbh *melâ* of 1879, which, like that of 1867, was characterized by a severe outbreak of epidemic cholera.

3. As late as the former Kumbh *melâ* at Allahabad of 1882, the sanitary arrangements of such fairs were of a primitive kind. The following quotations from the official sanitary report for 1881 indicate the inadequacy and imperfect nature of the sanitary control or almost complete absence of any sanitary administration of these assemblages. Doctor Planck, the then Sanitary Commissioner, writes:—

> "Almost from the first day of my arrival at the fair, much inconvenience was experienced from the unpleasant state of the atmosphere in and around my camping-place at Alopi Bagh, situated between the village of that name and Daraganj. And turning my attention to this circumstance, so soon as I had relief from the study of the fair site itself, a condition of widespread defilement of the surface was disclosed—widespread and general to an extent surpassing any thing of previous experience in all my years of Sanitary Commissionership. This great evil was and could never be properly dealt with. On the ninth day of the fair, I was driven to vacate my camping-ground."

It may thus be fairly assumed that while ordinary conservancy was little attended to, no systematic general or special sanitary precautions were adopted on such occasions.

4. Prior to the occurrence of the last Kumbh fair at Hardwar in 1891, the principal local officials, including the Civil Surgeon of the district, pronounced, in unmistakable terms, against according sanction to the assemblage of a vast concourse of pilgrims when the indications were considered amply sufficient to cause the gravest apprehension of a serious outbreak of cholera if the fair were not absolutely prohibited by Government.

5. The local Medical officer, the Civil Surgeon of the district, communicated officially with the Inspector General of Civil Hospitals and the Commissioner of the Division in these terms:—

> "In view of the approaching Kumbh *melâ* at Hardwar, I feel it incumbent on me to bring to your notice the following

facts which must be considered gravely significant of a serious epidemic of cholera arising should a large collection of people be permitted to assemble at Hardwar this spring.

"It cannot be said that the prevalence of cholera throughout the district was anything unusual in severity last year, as the mortality was only a little over 600. If however the incidence of the disease be examined in detail, it will be seen that from about the middle of September to the 23rd October, though sporadic cases were reported from various villages throughout the district, yet in none did the disease assume anything approaching an epidemic character until the 23rd October, on which date at a village called Bhulni in the Gangetic khadir, and a few miles from Hardwar, four cases with four deaths were reported. On the following day were reported twenty cases with twenty deaths, and on the following day twenty-eight seizures with six deaths. The epidemic lasted up to the 10th of November, and during that time there were seventy-one seizures and thirty-nine deaths.

"The occurrence of this epidemic thus late in the year in a locality which had hitherto been free from the disease and ominously situated on the Gangetic khadir, forcibly recall the similar conditions which preceded the cholera epidemic of 1879, and of itself might be considered sufficient to warrant the closing of Hardwar to pilgrims this year. I have however just received from the Magistrate of the district the cholera returns of Kumaun from the 29th to the 2nd February, from which it is shown that during those few days there have been twenty-eight seizures with twenty-three deaths in the various villages along the route which would be followed by intending pilgrims to Hardwar, four of the seizures occurring in pilgrims returning from Hardwar. When it is remembered that it was by the Kumaun pilgrims that cholera was introduced into Hardwar in 1879, these returns are most significant and appear to me to urgently necessitate the stopping of the approaching fair.

"The occurrence then of a cholera epidemic in the Gangetic khadir near Hardwar in October and November last year, the very unusual prevalence of cholera throughout Kumaun in 1890, and above all the recent appearance of cholera of a most virulent type along the pilgrim routes through Kumaun to Hardwar, constitute such powerful factors in the production of cholera at Hardwar and its spread thence throughout India that I believe the most complete sanitary arrangements will be powerless to prevent its spread should the contemplated fair at Hardwar be permitted to take place."

6. This communication was likewise addressed in protest to the Sanitary Commissioner as a warning in some measure that the most complete sanitary measures would be powerless to the spread of cholera should the contemplated fair at Hardwar be permitted to take place.

7. However the Sanitary Commissioner held to the view which he had definitely promulgated in a note published in the Annual Report of the Sanitary Commissioner with the Government of India for 1887, and was commented in a *Times'* leader in June 1889, that cholera is a preventible disease, and that it is possible, as far as human foresight and provision can allow, to prevent cholera from arising in these big fairs, or, if imported from the outside, to prevent its spread. The success of measures taken with this view is now a matter of history and has been referred to by the *Times* in a leader, dated 2nd February 1892, in the addresses delivered by Mr. Ernest Hart, the editor of the British Medical Journal, Dr. Klein, the adviser of the Local Government Board, and Dr. Simpson, Health Officer of Calcutta, who has personally seen and recorded the arrangements as observed at both Kumbh fairs.

8. The advice, therefore, to Government before the great assemblage at Hardwar, and few can measure the official importance of such advice given contrary to other expert opinion, was thus confidently given that the great Kumbh fair should not be prohibited, but that efforts should be directed to prevent people coming from infected tracts attending the fair, and that every endeavour should be made to prevent an outbreak of cholera by removing all causes which science shows to be predisposing to the disease, so that it might not originate in the fair, and, if imported, it should not spread.

9. Preliminary arrangements at these great fairs are now made with the purpose of locating the assemblage on the cleanest possible area and in actually seeing that the area, whether it comprises houses, huts, dwellings or encampments of whatever kind, is actually clean and fit and ready for occupation. Preliminary arrangements were instituted months before the great assemblage at Hardwar and weeks before that at Allahabad, and the police, medical, sanitary and conservancy staff also then fully determined.

10. In the final arrangements the sites for encampment are laid out in regular and systematic order, in sections and blocks, broad roadways, minor roadways and lanes, at right angles to each other, in regular succession. The entire area of the fair is divided into combined police, medical and sanitary sections, each under the charge of a police officer with a staff of constables, watchmen and medical subordinates and assistants, each and all assigned sanitary, in addition to their other, duties. The combined establishments from the sanitary patrol in each section and each constable and watchman, medical and sanitary subordinate, is assigned a fixed beat and definite duty with explicit instructions to:—(1) prevent overcrowding; (2) see to surface cleanliness; (3) give notice of and remove nuisances; (4) report offenders; (5) remove promptly and carefully those sick of infectious diseases; and (6) see to the proper locating of baggage and other animals. Conservancy arrangement is full and complete, and a large body of sweepers under jamadars properly arranged gangs are employed on conservancy and scavenging duty.

11. The effective inspection of each section of the fair is maintained by the police, medical and sanitary subordinates acting under the Deputy Sanitary Commissioner, who reports direct to the Sanitary Commissioner.

12. There are many lines of defence against cholera. The most exacting preliminary precautions with respect to surface cleanliness of site, dwellings, huts and encampment are required. Then there is the careful guarding of the water-supply; the preservation of the sacred pools and ghâts from undue pollution and contamination, in passing strong currents of fresh water through them and permitting the free flow of the river or the stream; the examination of the food-supplies; the systematic organization of the conservancy staff and establishments; the regulation of the crowds in transit, in camp, in procession, at bathing ghâts; the prompt notification of sickness of a choleraic or infectious

nature by a special detective staff; the isolation and proper care of the sick in organised hospitals; the immediate clearance and disinfection of the infected or supposed infected areas; the rapid removal of sewage, filth and rubbish beyond inhabited site, and attention to drainage within the occupied area; the full utilization of sanitary police and cordons; the employment of detective agents for sickness and to complete sanitary supervision and control by sanitary police and other officers.

13. The key to the success of the arrangements is (1) the preservation from pollution and contamination of the public water-supplies and the free flow of fresh water at bathing ghâts; (2) the strictest attention to every detail in conservancy and scavenging; (3) the immediate personal supervision of establishments by the sanitary and other officers concerned; and (4) the prompt notification of disease and clearance and disinfection of any infected or supposed infected area on the fair site. It is by such precautions only that we can prevent the occurrence of cholera, or limit the incidence of the disease, when it appears in these great gatherings of the people.

14. The general sanitary arrangements of the great Kumbh fair of 1891 at Hardwar were as follows:—

A.—DISTRIBUTION.

(1) The sanitary, medical and police sections corresponded, except that Rori Island, comprised two police sections instead of one sanitary and medical section, and the sanitary and medical sections of Kankhal and Shisham-ghât were also combined.

(2) Each sanitary section was also a medical section, and the combined sanitary and medical sections were as follows:—

1. Hardwar Town.
2. Bhim Goda.
3. Lal Jiwala.
4. Rori Island.
5. Chandi.
6. Kankhal and Shisham-ghât
7. Jawalapur Railway Station and Roads.
8. Mayapur and Jawalapur Road to Chah Ram Jas.

(3) Each hospital was constituted as follows:—

1 Native Doctor in charge.
1 Compounder.
1 Cook.
1 Bhisti.
1 Methar.
4 Kahars or bearers with one doolie.

The special hospitals were located:—

No. 1 behind the General Dispensary, Hardwar.
" 2 at Bhim Goda.
" 3 south of Lal Jiwala.
" 4 south of Rori.
" 5 at Chandi.
" 6 at Kankhal near police and octroi post.
" 7 near the crossing and Railway Station at Jawalapur.
" 8 on Jawalapur Road at Chah Ram Jas.

(4) The head-quarters of each sanitary and medical section were at the hospital above-mentioned.

(5) Each sanitary section was constituted as follows.—

SANITARY SECTION.	European Inspector.	Native Inspector.	Sub-Inspector.	Head Constable.	Constable.	Chaukidar.	VACCINATION STAFF.		
							Deputy Superintendent	Native Superintendent.	Vaccinators.
No. 1 ..	2	1	...	1	20	30	1	...	14
" 2 ..	..	1	1	..	10	16	..	1	8
" 3 ..	..			..	15	24	..		8
" 4 ..	...	1	..	1	10	16	..	1	8
" 5 ..	...	..	1	1	10	8	..		8
" 6 ..	...	1	..	1	10	16	..	1	8
" 7 ..	..	1	1	..	10	16	..	1	8
" 8 ..	...	1	1	..	15	24	..	1	8

These together with the police on duty formed the sanitary patrol, the constables and chaukidars having given beats. They, in addition to performing sanitary duty, formed detectives for sickness. Their duties were to—(1) prevent overcrowding; (2) see to surface cleanliness; (3) report and prevent nuisances; (4) report offenders; (5) remove promptly and carefully those sick of infectious disease; (6) see to the proper location of baggage and other animals. One doolie and two kahars or bearers were attached to each police station, and in the event of further assistance being required or necessary it was available at each section hospital.

B.—SANITARY PATROL AND INSPECTION.

(1) The Sanitary Commissioner and Deputy Sanitary Commissioner inspected each section at least once a day.

(2) The sanitary establishment as detailed, patrolled the fair at all hours of the day and night, and the duties were arranged in periods of six hours.

(3) The subordinate in charge of each sanitary section reported direct to the Sanitary Commissioner or Deputy Sanitary Commissioner, and accompanied the Sanitary Commissioner or Deputy Sanitary Commissioner in his daily round.

(4) All special occurrences between visits and general inspections were reported at once by messenger.

(5) It was the duty of the sanitary patrol staff under the Inspector in charge of sections to see to the prompt removal to section hospitals of persons suffering from diarrheoa and infectious disease or disease of a suspicious nature.

(6) All persons suffering from chronic disease or injury were removed to the Hardwar General Dispensary, the nearest Hospital Assistant available tending the injured, if possible, before removal.

C.—LATRINES AND URINALS.

The latrines were arranged on the dry-earth system, thus:—

(*a*) a layer of dry earth, at least three to six inches thick, formed each seat, provided with a "gumla" containing a little clean water for the reception of urine.

(*b*) at each latrine at least six "gharras," full of solution of perchloride of mercury, were kept in stock for sprinkling in and about the latrines, and the solution was used frequently.

(*c*) a quantity of carbolic powder was kept and used in and about the latrines in small quantity at least four times a day, (*d*) no wetting of the ground was permitted, and when this occurred the wet earth was at once removed and dry earth substituted, the place being disinfected with carbolic powder.

(*e*) all permanent or temporary urinals were free from odour by placing the "nands" or buckets in position $\frac{1}{6}$th full of clean water, and clean water was invariably placed in the vessels as soon as they were emptied of their contents.

The sweepers employed numbered over 1,300 and were distributed as per table.

Distribution Statement of Sweepers.

Number.	NAME OF SANITARY SECTION.	Jamadars.	Sweepers.	Total.	HAND BARRELS		CARTS.				BUFFALOES.				Single men on roads and camp.	LATRINES.		URINALS.		Reserved gangs each containing one jamadar and 10 sweepers.
					Number of hand barrels.	Number of sweepers.	For removing filth.	For removing liquid.	For removing rubbish.	Number of sweepers employed on carts.	For removing filth on "boras."	For removing liquid filth in "pakhals."	For removing rubbish on "boras."	Number of sweepers employed.		Number of latrines.	Number of sweepers.	Number of urinals.	Number of sweepers.	
1	Hardwar Town	28	261	289	4	8	12	4	3	38	..	4	2	6	50	13	96	25	25	6
2	Bhoni Goda	7	79	86	..	..	..	..	2	4	..	..	..	..	15	10	44	12	12	1
	Laljiwala	9	99	108	..	..	..	..	2	4	..	..	..	..	20	12	50	12	12	2
4	Rori Island	11	105	116	..	..	..	..	2	4	..	..	..	..	30	8	48	12	12	2
5	Chandi	4	46	50	..	..	..	..	..	..	..	..	..	..	15	4	20	4	4	1
5	Kankhaland Shishamghât	11	107	118	..	..	..	..	2	4	2	2	..	..	40	7	42	10	10	2
7	Jwalapur Railway Station and Roads..	10	105	115	..	..	..	..	4	8	..	..	..	..	25	11	50	10	10	2
8	Mayapur and Jwalapur Road to Chah Ram Jas.	14	146	160	2	4	1	1	3	10	..	..	..	..	40	15	74	10	10	2
	TOTAL ..	94	948	1,042	6	12	13	5	18	72	2	6	2	6	235	80	424	95	95	18

N.B.- A reserve (1st) of 100 sweepers will be required for the Horse Fair.

A reserve (2nd) of 200 sweepers will be required for the seven last days of the Fair in addition to the total 1,042 now entertained.

In addition to the above establishment, dry earth was regularly supplied to various latrines by a relay of ponies provided by a contractor, and a service of ponies with boras was provided for conservancy purposes in Rori.

15. All ordinary and certain special sanitary precautions, prior to and including the time when the fair was at its height, were strictly enforced, and rigid personal inspections of every nook and corner of Hardwar regularly made.

16. There was no house or spot of Hardwar town that was not closely scrutinized almost daily. All sullage water and refuse was removed from within the limits of the town at stated periods.

17. No sullage water was allowed to run into streets or lanes, and everything of a deleterious nature was removed from the premises beyond town limits. Any fouling of the ground in and about dwellings was prohibited.

18. All private and public latrines were under direct control and all private latrines not kept in a satisfactory condition were either promptly demolished or closed, and the ground cleansed and purified.

19. Temporary latrines and urinals were placed at all convenient spots in the town and along roadways, and urinals were kept clean and free from odour by using pure water as a recipient and by cleansing the vessels with disinfectants as required.

20. No refuse, sullage water, or filth was allowed to be trenched, pitted, or to accumulate in the town of Hardwar, and before and during the fair all night-soil, etc., was carefully removed from within the limits of the inhabited area

21. The chief disinfectant relied on was perchloride of mercury in solution, and it was freely sprinkled everywhere as required, especially in latrines, over washing vessels, urinals and elsewhere where necessary.

22. The tendency of the natives is to resort to any retired spot, but such habit was restricted and controlled, though not without some resistance at first, and a resistance more or less determined which disappeared when nature could be obeyed in a cleanly and orderly manner. A large body of the respectable Sikh community, the Nirmalla Akhara and others, were gently persuaded from irregular into cleanly and orderly habits without difficulty. Cleanliness is appreciated by the natives, and cleanliness is freedom from odour, nuisance and annoyance, and the conveniences at Hardwar might have been entered by a European without offence.

23. The almost total immunity of the crowds from infectious and epidemic disease was the chief feature of the Kumbh *mêla* of 1891, and may be justly ascribed to the thorough sanitary control and inspection of Hardwar and the Hardwar Union during the period before the crowds began to assemble and while the fair lasted. There was no house or compound in Hardwar which was not, as recorded, under personal supervision and inspection, and the strictest attention was paid to the cleanly condition of roadways, open spaces, compound, sullage vessels, latrines, urinals, etc.; so much so that all filth, refuse or foul water was intercepted and removed from the inhabited quarter. The latrines for the most part were kept in a condition to which, as stated, even a fastidious European could not object; and the careful removal of all filth and soiled earth, and the free use of perchloride of mercury undoubtedly lessened the chance of infection, although introduced, from spreading from any given centre.

Besides in all cases of suspicion the area of supposed infection was immediately cleared and disinfected, and on the occurrence of the first suspicious case of cholera, the portion of Chhota Laljiwala, from which the patient was removed, was forthwith vacated and closed to the public within the period of supposed secondary infection.

24. There was not a single case of cholera reported in the western districts of the province on and after the dispersion of the crowds on the 13th April up to and including the 30th of the month. The "unparalleled result" of an almost total immunity from cholera at a Kumbh *mêla* and the dispersion of the crowds free of epidemic cholera was only obtained, as indicated, by rigid personal attention to sanitary details; to the careful and early removal and isolation of suspicious or actual cases of disease; and to the clearance and disinfection of supposed areas of contamination and infection.

25. The truth of the statement that cholera is a preventible disease, as demonstrated in the memorandum attached to the Report of the Sanitary Commissioner with the Government of India for 1887, and which formed the subject of a leading article in the *Times* of the 12th June 1889, has been established in many ways, but no more important or practical illustration of this truth has ever been placed on record than the immunity from cholera following the great fair, or Kumbh *mêla* of 1891, and the dispersion of hundreds of thousands of pilgrims to all parts of India free of epidemic disease. Such a demonstration of the preventibility of cholera was all the more important, as an outbreak was actually anticipated, and in the opinion of those best qualified to judge "there was very grave reason to fear a repetition of the terrors of the previous great pilgrimages."

THE ALLAHABAD KUMBH.

26. The great *mêla* or Kumbh of 1894 at Allahabad lasted from the 12th January to the 20th February. The opening day was the 12th January, when the religious procession of the chief *akharas* took place, and the great bathing day was the 5th February, after which the mass of the people rapidly dispersed to their homes in every part of India.

27. The concourse of people on the fair site ordinarily did not much exceed 100,000 daily, of whom not more than 50,000 were resident on the ground. But prior to the great bathing day, the 5th February, the assemblage increased enormously, until, on the morning of that day, there were at the lowest computation 2,000,000 persons present to witness the great religious processions and take part in the ceremonies.

28. Owing to the set of the main Gangetic stream after the heavy fall of rain in the hills and elsewhere about the middle of October, the site of the fair could not be definitely fixed till late in December, when it was finally determined to locate the religious brotherhoods or *akharas* on the chur on the left bank of the stream and to lay out the fair proper on cantonment land to the north and north-west of the Fort. The chur on which the *akharas* were located was connected with the right bank of the stream and with the approaches to the bathing ghât by a bridge of boats, which, owing to the rise and fall in the river and defective construction, only imperfectly served its purpose.

29. The chief feature in the arrangement was the distinct separation of the religious brotherhoods from the ordinary pilgrims and their location on different ground. The arrangement is one to which the Mahants or leaders of the religious sects invariably adhere, as at Hardwar and elsewhere where the *akharas* keep themselves to distinct enclosures and thus maintain the personal privileges of being interviewed in the sanctuary of their own particular temple (a domain which at Hardwar is reserved to them by Government by *sanad* or hereditary claim).

30. The chur of the river on which the *akharas* were located was mostly an alluvium or silt with large admixture of sand, of this season's formation, at an average elevation of about 12 feet above the river. To the south and south-west of the chur was a long stretch of low-lying silt extending to the junction, called Tribeni, of the rivers Ganges and Jumna, which flow from this point in broad stream south-eastwards. The main stream of the Ganges prior to joining the Jumna flowed almost directly southwards and under the west face of the *akhara site*. To the eastward of the site was a broad belt of alluvian and sand extending to a minor branch of the Ganges flowing under the high left bank of the river at Jhusi.

31. The general site of the fair, with its broad streets of shops, was on the alluvial cantonment ground situated within and to the west of the Beni bund or embankment which extends north from the Fort to Daragunj. This outlying village or suburb of the municipality is built on the right bank of the Ganges and on the embankment, the Grand Trunk Road passing through dividing the suburb into a northern and southern portion as it extends to the temporary pontoon bridge which here crosses the Ganges.

32. A broad road space, about 100 yards wide, running eastwards from the bridge separated the two main divisions of the *akhara site*. The Nirbanis, Niranjanis, Jhunas and Nirmalas were located in the northern division in consecutive order from west to east and the Chhota Udasis, Bara Udasis and the large body of Bairagis had their respective less regular camps in the southern division of the site.

33. The general site comprised a broad street of shops on the south at the foot of the northern slope of the Fort, and an extensive camp immediately to the north laid out in regular lines at right angles to each other. There were broad roadways as main thoroughfares and minor roads and lanes laid out on definite lines.

34. The general administration of the fair was in the hands of the Magistrate and Collector, Allahabad district, assisted by the Sanitary Commissioner, North-Western Provinces and Oudh, acting as his expert adviser. The executive was carried on by the following officers :—

(1) Special officer in charge of the arrangements as Magistrate under the Magistrate and Collector.

(2) Deputy Sanitary Commissioner as Executive Sanitary Officer.

(3) Assistant District Superintendent, Police, as Executive Police Officer.

These three officers, at the suggestion of the Sanitary Commissioner, conferred daily at a fixed hour anent the general conduct and effective carrying out of the details of the fair.

35. For general and special administrative purposes, the fair site was divided into seven thana areas for police, medical and sanitary purposes, and the sections or areas for such purposes corresponded. Every member of the Police force was assigned sanitary duty in addition to his duty of watch and ward.

36. On the general site and at the Fort Railway Station the filtered municipal water was laid on throughout, and standposts were placed at all convenient places at an average distance of 150 feet apart. Each standpost was surrounded by a platform with flagstone paving, and the surplus and overflow water was let into pools, from which the accumulated water was removed to water the roads. The wells on the general site were closed and fenced in.

37. The religious bodies on the *akhara* site had to procure their drinking water from the main stream of the Ganges, as all other sources of supply were interdicted. An attempt was made to raise water from temporary wells into cisterns on some of the *akhara* sites for washing and other purposes, but owing to the indifference and passive obstruction of the Mahants, this source of supply was not generally used. The water-supply, therefore, was excellent, and unexceptionable on the general site and good, though liable to impurity as taken from the river on the *akhara* site. The use of back waters was, as far as practicable, interdicted, and one large back water on the bed of the river, below the main approach to the bathing ghât, was carefully guarded against use.

38. Ample provision was made for all conservancy purposes, and any strain that occurred was well met. The latrines on the *akhara* site were worked on the trench system, and there was a police cordon within which the latrines were placed at convenient distances. On the general site the latrines were on the dry-earth plan, the urine and solids being removed separately in iron vessels.

39. The leading feature of the conservancy arrangements on the general site was the prompt removal of urine and solids by tram beyond the fair site, and the systematic trenching of the filth under strictly military arrangements and rules. The tram was run throughout without hitch of any kind. Ample urinal accommodation was provided, and there were lines of these conveniences at specified intervals. The rubbish and sweepings were removed by cart, and in some cases burnt to facilitate removal where the accumulation was necessarily large. A few private latrines were licensed, but on complaint made by the inspecting staff, those that were not kept in order were promptly removed.

40. The general sanitary arrangements are indicated in the following memorandum of instructions issued at the commencement of the fair :—

The Deputy Sanitary Commissioner will be the Executive Sanitary Officer of the fair, and shall keep direct touch with the officer in general charge.

A.—Distribution of the Sanitary Staff.

(1) The Sanitary, Medical and Police Sections of the fair correspond.

(2) There are seven sanitary sections :—
A, B, C, D, E,—on general site.
F, G,—on the *akhara* site.

(3) The head-quarters of each sanitary and medical section is the thana.

(4) Each section is constituted as follows :—

(*a*)—Sanitary.	(*b*)—Medical.
(1) One Inspector of Police, (Sub-Inspector or Head Constable).	(1) One Assistant Surgeon (or Hospital Assistant).
(2) Four Constables.	(2) Four Kahars with stretcher.
(3) Twenty Chaukidars.	

(5) The above establishment will, with the assistance of all the police on duty, form the sanitary patrol, each subordinate having an assigned beat.

(6) The duties are :—1. To perambulate every portion of the fair. 2. To prevent over-crowding. 3. To report and prevent nuisances. 4. To report offenders. 5. To detect and at once report sickness. 6. To remove promptly and carefully those sick and injured.

B.—Sanitary Patrol and Inspection.

(1) The Deputy Sanitary Commissioner will inspect each section at least once a day.

(2) The sanitary staff as detailed will patrol the fair at all hours of the day and night.

(3) The subordinate in charge of each sanitary section will report direct to the Deputy Sanitary Commissioner and will accompany him in his daily round.

(4) All special occurrences between visits and general inspections will be reported at once.

(5) It will be the special duty of the sanitary patrol staff under the inspector in charge of section to promptly report sickness and see to the careful removal to the special hospital of persons suffering from diarrhœa or other diseases of an infectious or suspicious nature.

(6) All persons suffering from chronic disease or injury should be removed to the Colvin Dispensary, the nearest medical subordinate available tending the injured before removal.

C.—Water-supply and Food-stuffs.

(1) A piped water-supply will be laid on from the municipal mains, and there will thus be an abundance of pure potable water available at different points on the site of the fair.

(2) The people should be encouraged to draw their supply from the above source, or from the running stream only.

(3) They should be interdicted drawing water from, or washing in puddles or back waters.

(4) The Deputy Sanitary Commissioner, in communication with the officer in general charge, shall see that the food-stuffs supplied to pilgrims and others are of fair quality and in no case bad or unwholesome.

D.—General Conservancy.

(1) One European Cantonment Inspector and two Assistant Inspectors will supervise the collection, removal and proper disposal of night-soil, urine, sullage and rubbish.

(2) The latrine arrangements will be on the dry-earth system and the solid and liquid filth shall be removed and disposed of separately.

(3) There will be a sufficient store of dry earth under cover for use in each latrine.

(4) A tram line will be laid for the prompt and sufficient removal of the night-soil and rubbish from the main site.

(5) The latrines on the site of the general fair will have more or less fixed seats, consisting of a layer of dry earth, 4 inches deep, provided with two pans, one for the night-soil and the other for urine ; the pans to be placed on the platform of dry earth which, if soiled, shall be instantly removed.

(6) The night-soil will be trenched beyond the site of the fair on the military system in a strictly regular manner.

(7) The latrines on the *akhara* site will be on the trench system. All night-soil to be promptly covered in with dry earth.

(8) Each latrine will be provided with two screened places for ablution with vessels for the proper reception of washings. This vessel to be surrounded with earth or sand to be frequently renewed to the depth of six inches.

(9) At each latrine six "gharas," full of solution of perchloride of mercury, shall be kept in stock for sprinkling in and about the latrines and washing vessels, and the solution should be used frequently; a can with rope attached being provided for this purpose.

(10) A quantity of carbolic powder should also be kept in stock and used in and about the latrines in small quantity at least four times a day.

(11) No wetting of the ground should be permitted, and when this occurs the wet earth should be at once removed and dry earth substituted, the place being disinfected with carbolic powder.

(12) The site of any latrine shall be promptly changed when necessary, the old site being carefully disinfected and covered over with dry earth.

(13) There shall be a sufficient number of screened urinals placed in convenient positions throughout the site of the fair.

(14) The urinals shall consist of a "nand,"* one-fourth filled with fresh water, to which a small quantity of mercuric perchloride solution has been added; the fresh water to be invariably renewed when the urinals are emptied of their contents.

(15) The site of any urinal shall be promptly changed, when necessary, the old site being carefully disinfected and covered over with a thick layer of dry earth.

(16) Sullage water will, as far as practicable, be removed to a place set apart for the purpose.

(17) Rubbish will be removed beyond the site of the fair for disposal at places set apart for the purpose.

E.—Reports.

(1) A report showing the distribution of the sanitary staff and the conservancy establishment should be furnished on the day preceding the opening of the fair and weekly thereafter till its close.

(2) A general death and casualty report should reach the Deputy Sanitary Commissioner not later than 8 A.M. each day.

(3) All special occurrences should be at once reported to the Deputy Sanitary Commissioner.

(4) Ordinary verbal reports to be made at general inspection of sanitary sections.

(5) A general sanitary report, comprising all matters of sanitary and medical importance occurring within the previous twenty-four hours, should be submitted by the Deputy Sanitary Commissioner to the officer in general charge at 10 A.M. each day, a copy to be sent to Sanitary Commissioner for information at the same hour.

F.—Notification of Infectious or Epidemic Disease.

(1) On the occurrence of cholera, suspicious diarrhœa or small-pox, the fact should be notified forthwith to all concerned, the officer in general charge and the Deputy Sanitary Commissioner in consort taking necessary steps to prevent the dissemination of disease by isolating the sick and those likely to spread infection, and by the prompt clearance and closure of any hut or section of the fair.

There is a force of 1,340 sweepers employed on latrine, urinal and scavenging duties, and the following statement shows the distribution of the conservancy establishment :—

Distributoin statement of conservancy establishment attached to the Magh Kumbh Fair of Allahabad for the year 1894.

Number.	Name of the Site.	Jamadar.	Sweepers.	Total.	Trolleys or Hand-carts.				Sweepers employed on principal roads, river bank, back waters, and pools, &c.	Sweepers employed on general surface and trenches, &c.	Latrines.		Urinals.		Reserve gang.	Remarks.
					Trolleys for excreta.	Trolleys for dry rubbish.	Hand-carts for rubbish.	Number of sweepers employed on trolleys or hand-carts.			Number of latrines.	Number of sweepers.	Number of urinals.	Number of sweepers.		
1	General	11	722	733	13	12	4	50	110	202	21	213	60	60	89*	*Sweepers ... 87 Jamadars ... 2 Total ... 89
2	*Akhara*	17	555	572	...	...	...	...	48	150	23	200	24	48	111†	†Sweepers ... 109 Jamadars ... 2 Total ... 111
	Jhusi (unauthorized camp) ...	1	34	35	...	...	...	...	...	17	...	...	...	17	...	
	TOTAL ...	29	1,311	1,340	13	12	4	50	158	369	44	413	84	125	200	

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* A large earthen vessel.—Ed.

41. E. H. Hankin, Esq., M.A., Bacteriologist to the Government, North-Western Provinces and Oudh, made a series of exact bacteriological examinations of the waters of the Jumna and Ganges at Allahabad at the junction of the two rivers, and of pools, bathing ghâts, etc., in Allahabad, at the time of and after the Kumbh *mêla*. Such an examination had not hitherto been attempted; and the value and importance of the observations will be acknowledged by all scientists.

Further, while practical sanitary measures were being rigidly carried out, the sanitary aspect of this large assemblage of people was carefully studied from the scientific and bacteriological point of view.

24. The general series of bacteriological observations are summarized in the following table:—

Table showing the distribution of microbes in the waters of the Jumna and Ganges, of wells, pools, bathing ghâts, etc., before and after the great bathing day (the 5th February) during the Magh Kumbh *Mêla* of 1894:—

Locality of Observation.	Date of Observation.		
	4th February.	5th February The great bathing day.	17th February. When the fair had practically broken up.
Jumna midstream, opposite water works	360		
„ „ above Jumna Bridge	300		
„ „ below „ „	660		
„ water works intake ...	2,100		
„ intake well	1,204		
„ below water works	2,400		
„ at a point where the river infringed on bank	540		
„ at washing ghât	26,880		
„ „ „ „ another point ...	153,600		
„ „ „ „ „ , ...	23,080		
„ „ „ „ nearer Jumna Bridge ...	117,200		
„ „ „ „ opposite Fort ...	2 100		
„ „ „ „ Fort face ...	1.620		
Sacred bathing ghât	4,080	97,200	96,000
Beyond „ „	6,960	96,000	
„ „ „	1,800		
Opposite the „ (Boats moored) ...	7,920		
Line of junction of waters of two rivers	2,280		
„ „ „ „ „	1,800		
Ganges bathing ghât	38,400	......	5,700
„ „ „ left bank ...	3,000		
„ above the bridge-of-boats at Daragunj	1,800	......	1,250
Standpost municipal water supply on fair site	212	......	160
Ganges back water	34,800	......	4,600

Previous to these bacteriological demonstrations, it was realized that excessive pollution of even a running stream occurred at washing and bathing ghâts, and at important bathing ghâts, such as at Harki-pahri at Hardwar, special precautions were taken with a view to keep the sacred pool as free as possible from pollution. The extent of such pollution, and it may be contamination of even running water, can scarcely be realized by the ordinary mind, and the results of the tabulated observations show the extent of deterioration in a marked degree.

The small number comparatively of microbes in the filtered water as supplied to the inhabitants of Allahabad and on the fair site, namely, 160 per cubic centimetre, contrast favourably even with Jumna water taken from midstream and with that of Ganges water, all of which, however, contrast favourably with the waters of the rivers near washing and bathing ghâts. The number of microbes ranged from 38,400 to 96,000 at the sacred bathing ghât at the junction of the two rivers, and this practical demonstration confirms the practical view of the absolute necessity of keeping up as far as practicable, or inducing a strong current at the principal bathing ghâts, especially where pilgrims assemble in large or considerable numbers.

43. We have thus briefly reviewed the sanitary arrangements at the recent Kumbh Fairs at Hardwar and Allahabad. On the strictness and thorough control of these arrangements depend, not only the freedom from epidemic disease, but also the general health, comfort, and convenience of the immense concourse of human beings, who frequent and are likely to frequent these fairs and festivals so long as the Hindu faith appeals to the teeming millions of Hindustan.

PURI PILGRIM CANAL TRAFFIC.

BY P. W. O'GORMAN,

Surgeon-Captain, I. M. S.

So vast is the concourse of pilgrims from all parts of Hindustan that annually converges on the ancient Hindu shrine of Puri or *Jugannath* in Orissa, that at least two of the principal Steamer Companies in India have permanently established regular services for the conveyance of passengers from Calcutta alone to Cuttack, the nearest port to Puri by canal; while two other regular lines operate by the sea route from Calcutta to Chandbali. Besides these, numerous country boats ply, even up to Puri, from various places; and in times of exceptional crush, as occurred last year, besides the British India Steam Navigation Co., several casual steamers took up the traffic in competition. In addition large numbers of pilgrims travel overland, the poorest on foot. To give some idea of the latter, I append below a table showing the probable number of such who have passed through the town of Midnapore alone (on the Burdwan-Balasore-Puri Trunk Road) during the last three years. I have calculated this from the amount of money expended here in charity to pilgrims by Raj Kumar Norendro Lall Khan, each man receiving a dole on an average of 9 pies:—

Year.	Rupees expended.	Equivalent to number of pilgrims @ an average of 9 pies per head.
1893	2,000	42,667
1892	1,790	38,187
1891	1,810	38,613
Total ...	5,600	119,467
Annual average	1,800	39,822

The pilgrims are relieved going and coming; so if we take half under each head, we get (say) 20,000 persons passing Midnapore yearly, 1,670 monthly, or 55 per day.

Pilgrims travel to this shrine at all times of the year, but there are three principal festivals at which they congregate in largest numbers, namely :—

1. The *Dole Jatra*, in March.
2. The *Rath Jatra*, in July as a rule.
3. The *Panchak*, in November.

Of these the *Rath Jatra*, occurring at the unhealthiest time of the year, when cholera and fever are most rife, and particularly fatal to returning pilgrims, is the greatest. It is at this time, too, that the "*Naba-Kalebar*" (Bengali) or "*Nua-Kabebar*" (Oriya), or the renewal of the idols, takes place every twelve years, when the assembly of visitors multiplies to even eight fold, as it did last year. The following table of estimates will give an idea of the numbers that annually visit Puri :—

	Dole *March.* ...	Rath *July.* ...	Panchak *November.* ...	Total ...	Average of five years ...	Average of ten years ...
1884.	30,000	50,000	30,000	110,000	121,200	104,600
1885.	80,000	70,000	40,000	190,000		
1886.	15,000	80,000	16,000	111,000		
1887.	50,000	20,000	50,000	120,000		
1888.	20,000	30,000	25,000	75,000		
1889.	20,000	30,000	12,000	62,000	88,000	
1890.	15,000	20,000	15,000	50,000		
1891.	10,000	15,000	8,000	33,000		
1892.	15,000	15,000	5,000	35,000		
1893.	20,000	200,000	40,000	260,000		

Thus an approximate average of 104,600 persons flock every year to Puri. The proposed Calcutta-Midnapore-Cuttack-Madras Railway alone can deal with such enormous traffic. But meanwhile the canal, river and sea vessels do an immense business, and no doubt *will continue to do* even in face of the railway. And yet these are absolutely *uncontrolled* for all practical purposes by any law or regulation for *the health, convenience, comfort, or even personal safety* of their passengers, although the railway companies, under similar circumstances elsewhere, are bound down by stringent stipulations. As for *steamers* the "Indian Steam Ship Act" insists only on (1) qualified officers being carried; (2) certificates of survey being furnished; and (3) number of passengers thereon being limited. But it gives no authority over the *flats and barges* towed by them, which are really *the* passenger vessels where pilgrims are concerned. So also with the "Inland Steamer Vessel Act:" both are practically useless so far as their boat passengers are affected. Then, as regards *boats*, the "Canal Act" of 1864 gives absolutely no power to regulate this traffic in boats in canals or rivers in any way.

It is clear, therefore, that new legislation is badly wanted, not alone for pilgrims, but in the interests of passengers generally. How this is to be undertaken with so many conflicting interests at stake is very difficult to say. So far as concerns the professional side of this question, which indeed is the main one, I beg to submit my proposals, however imperfect, for helpful consideration. There are three principal routes by water from Calcutta towards Puri (the minor routes may be omitted) :—

I.—*Marine Route:* By sea to *Chandbali* and thence by local steamer companies or country boats to *Cuttack* or *Puri.*

II.—*Orissa Coast Canal Route:* By river and canal *via* Gewankhalli (Midnapore District) to Nulkool and thence to Cuttack.

III.—*Midnapur Canal Route:* By river and canal *via Uluberia* to *Midnapore* (taking 14 hours) and thence by the Grand Trunk Road to Balasore, Cuttack and Puri.

Pilgrims affect the first two routes, usually by Messrs. Hoare and Miller (Calcutta Steam Navigation Co.), whose vessels mainly ply in routes II and III, in communication with the India General Steam Navigation Co. between Nulkool (Balasore) and Cuttack; in No. II, they have kindly supplied the following figures of their passenger traffic for the past five years on this line :—

YEARS.	From Calcutta to Cuttack *viâ* Gewankhalli.	From Calcutta and intermediate stations to Midnapore.
1893	16,750	43,900
1892	8,780	37,900
1891	4,700	36,500
1890	6,600	41,700
1889	9,590	41,800
Total ...	46,420	201,800
Annual average	9,284	40,360
Total average of both services ...		49,644

If we take three-fourths to half of this total for all other steamers and the remainder for country boats, and double this for return passages, we may strike a very rough average estimate of the marine passenger traffic in this part of the province, *viz.*, about 200,000 persons every year, a large proportion being pilgrims.

But probably somewhere between 4 to 500,000 would not be an excessive estimate in some years.

That much suffering, discomfort, exposure, starvation, sickness and actual loss of life, direct and indirect to passengers themselves, and afterwards to inhabitants of their native villages and districts, result only far too evidently. So that the affected districts in the divisions of Orissa and Burdwan have always been notorious for their heavy mortality, and their virulent epidemics of cholera and small-pox, which are now also perpetual endemic residents of these areas. Owing to the exceptional rush of pilgrims last year and the natural anxiety of the authorities to hasten them out of Calcutta, where cholera had appeared among them, many steamers failed to carry out their contracts, although their fares were enhanced; passengers who could ill-afford it were temporarily abandoned without shelter, and in the rains, in comparatively lonely places, mid-route to their destinations, for want of accommodation in communications. Although two of the great steam companies provided food liberally, casual steamers did not, and one firm deliberately kept them at a lonely lock for three days without provisions of any kind. Speaking of the canal routes particularly, it is well-known that the steamers, and towed barges and flats especially, were overcrowded with human beings.

The following are the proposed "*Restrictions and safeguards in the conduct of the pilgrim passenger traffic :*"—These are more or less in accord with what all the Railway Companies on the chief pilgrim routes deem it incumbent to follow under orders of Government. Although originally intended for the pilgrim traffic alone and for canal steamers and their tow of barges and flats, it appears to me advisable to extend their application where and when needed, and with the limitations or modifications that circumstances call for, to *all passengers* and to *all steamers* and *the flats, barges and boats towed by them*, and to *all country boats carrying, say*, 12 *and more passengers* engaged in this part of the province. For unless matters are equalised for all competitors, the scheme would not work, but do harm. Without a system of *moderate-priced licenses*[*] *and registration*, I fear little could be done that could not defeat its own object, unless, perhaps, *special concessions in the way of toll charges.* As a set off towards the extra expenses and towards improvement of sanitation in Puri and lines of routes, the suggestion of Dr. Banks, Civil Medical Officer of Puri, that a *pilgrim tax* should be imposed, appears to merit some consideration. I would suggest that 12 pies per head would not be felt, and in the case of marine passengers may be collected direct from the companies. This would bring in an annual income of say about Rs. 6,500.

I.—Relating to Passenger Vessels.

I. Separate Accommodation for the Sexes on Board.—There should be separate accommodation on board steamers and tow barges and flats for the sexes, married or single, and for the little children who accompany them. A canvas screen would suffice.

II. Overcrowding on Board and Regulation for allotting space for Passengers.—Overcrowding on steamers and their tows, especially in closed barges between decks, and with deficient ventilation, is very baneful in every way, and should be strictly put a stop to. Every pilgrim should have a certain definite amount of space allotted to him by regulation. If the *superficial area were marked off by painted lines and numbered* much would be gained. The Indian (beyond sea) Emigration Act $\frac{1883}{1890}$, Chapter IX, section 57, provides a height in every part of not less than six feet, and section 58 lays down 12 superficial feet and 72 cubic feet space for each emigrant.

III. Protection of Pilgrims from exposure to Season and Weather on Board.—Arrangements should be made to protect passengers on board from exposure to rain, cold and heat of the sun, according to the weather and the season of the year.

IV. Latrine Accommodation on Board.—The latrine accommodation on board is very defective. It should be located well aft, afford privacy, be made much cleaner, with a chained iron tarred bucket for ablution purposes, and be made more ample. The Bengal rules under the Assam Emigration Act (sections 101-102) provide four compartments for any number up to 200 persons, and an additional one for each 100 above. There should be either separate latrines on opposite sides for the *sexes*, or separate compartments, with designation boards above each. These should be easily approachable from all parts by a clean-kept central railed gangway.

V. Hospital Bholio or Boat in tow of Vessel—On orders from the Magistrate, or his Deputy, it should be incumbent on every passenger vessel to attach to it a separate *Bholio on boat* called the *Hospital Bholio*," divided into two compartments, suitably fitted up for the immediate isolation and treatment of all sick from cholera or small-pox, and for the conveyance of the dead respectively. The "*Hospital Bholio*" to have all the necessary conveniences, medicines, disinfectants, and dietetic necessaries required for the treatment of the sick, with one *sweeper* to act as "*Hospital attendant.*" A high caste "manji" or boatman may be utilized to administer diet, etc., that may be urgently necessary till the patient can be landed. As regards recognized country "passenger boats" of smaller size, a *separate hospital apartment* for the sick, in lieu of a "*bholio*," should be stipulated for. It should be recollected that several days sometimes are taken on this journey.

VI. Medical Conductors on Board.—To avoid extra expense I much approve of the excellent proposal of the Inspector of Police, Contai, that the "conductors" or "guards" of these vessels be selected from the *Passed Hospital Assistant Class of* medical men, preferably High caste Hindus (failing whom passed compounders may suit), whose respectability would be a sort of guarantee of their honesty and reliability, and whose special training could be utilized for overlooking the sanitation of the vessels and the treatment of such persons as fall sick *en route* between stations. The advantages both to the company and to the passengers are obvious. A separate medical officer for each vessel would not then be needed.

VII. Joint responsibility of Serang and Medical Conductor.—The serang or master and the medical conductor should be held jointly responsible for the general care and good treatment of their passengers; special brief rules may be drawn up for their guidance. They ought to remove all foul rags, etc., and prevent consumption of unwholesome food. For suggestions on this head see rules under the Assam Emigration Act, Parts IV, V and VI, and Form No. 35 (Instructions to Medical Officer). As Dr. Banks recommends, they should keep a *register of deaths*, entering disposal of bodies and their effects, etc. I think a brief *daily diary of events* on each journey should be maintained, entering, among other things, number and nature of sick (with names, etc)., treatment and disposal of patients, appearance of infectious disease, and resulting sanitary measures, etc., etc.

VIII. Company's European Travelling Inspector and Government Inspecting Officers.—*A Company's European Travelling Inspector*, where possible, should be maintained to see orders and regulations carried out; and the following *Government Officers* should be *empowered to inspect* all such vessels, bholios and passenger boats: (1) District Magistrate, (2) Civil Surgeon, (3) District Superintendent of Police, (4) Inspectors of Police, (5) Sub-Divisional Officers, and (6) Assistant Surgeons and Civil Hospital Assistants within their administrations, and all sanitary and medical defects reported.

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[*] For suggestion see Indian Emigration Act, 1883-1890, Chapter XII, sections 86-91, among others. Inland Steam Vessels Act, 1884-1890, Chapter VII, and Assam Labor Emigration Act, 1882-1893, the and rules under it, by Bengal Government.

IX. Disembarking and Embarking Passengers, Lanterns and Communicating Stages.—For the safety and convenience of passengers and to avoid accidents, all vessels, particularly in conection with steamers, should come to a *dead stop* at the landing stages when disembarking or embarking passengers; suitable wide *communicating stages* should be provided with hand rails on both sides, and at night a sufficiency of *lights* should be displayed, including those to guide passengers to the latrines.

X. Cleansing and Disinfection of Vessels and Hospital Bholios.—On the termination of each journey at each terminus, at the appointed places only every vessel and its "*Hospital bholios*" should be *thoroughly disinfected and fumigated*, the latrine thoroughly purified, and the whole vessel generally washed, scrubbed and *dried* prior to the reception of fresh passengers.

XI. Prohibition of Increased Rates for Fares by Carrying Companies.—Steamer and other carrying companies and ferry ghât keepers should *not be allowed to raise their rates for fares at pleasure.* The consequence of such unexpected extortion is that many unfortunate pilgrims are unable to continue their journey, and those who risk it are necessarily deprived of, not only ordinary personal comforts, but are compelled to starve themselves after compliance with such demands.

II.—Relating to Stations.

XII. Landing Stages.—Every station should be provided with proper landing stages, at which all vessels should *be made to stop*, and at night, where necessary, a sufficiency of *lights* be displayed.

XIII. Waiting Shelters.—At certain suitable *terminal and intermediate stations* along the passengers' route to be selected according to the traffic requirements, among which the assembly of passengers and the suitability for sufficiently long halts for the purpose of allowing passengers from the steamers to bathe and cook their meals, and to resort to the latrines (especially women), should be considered; the most important *waiting sheds* of sufficient size should be erected. These should be in two or more well protected blocks, accommodating not more than 50 persons each, with an area of not less than 60 square feet and 810 cubic feet per man, to allow of free ventilation and to avoid overcrowding.

XIV. Provision and Distribution of Pure Drinking Water.—At all such intermediate stations and at the principal locks the company ought to maintain an ample supply of *boiled and filtered drinking water for distribution to passengers* by Brahmin water carriers. The drinking of brackish and foul water, such as is now only available, is an important factor in bringing about cholera and bowel disorders. If no suitable water can be had at present, wells ought to be sunk.

XV. Canal Station Hospital and Staff.—At these intermediate stations, as well as at the termini, a hospital, consisting of three or more separate buildings, with a mortuary hut, should be erected at a safe distance for treatment of all cholera, small-pox, and other serious cases, sufficiently provided with medicines, disinfectants and necessaries, and with a staff of one *hospital assistant*, one Brahmin as *cook*, water carrier and general attendant, and one *sweeper*.

XVI. Duties of the Station Medical Officer.—All cases occurring on board passenger vessels to be removed from the "*Hospital Bholio*" for detention here, until fit to proceed. *The duties of the Medical Officer to include* careful daily inspections of the station and assembled passengers and all arriving passenger vessels, with *power to prohibit from embarking, or to forcibly remove* from the vessels, with their dependants, guardians, or companions, to hospital for treatment, such as are unfit to proceed; and to submit to the Civil Surgeon weekly reports, and be under his general supervision.

XVII. Latrines at Stations.—At these stations, suitable *latrines* on the dry-earth system should be provided separately for the sexes, and the removed night-soil daily trenched in a distant site to leeward.

XVIII. Cremation Grounds.—At these stations, not less than 500 yards to leeward of the "waiting sheds" or ghât, a site should be selected for a *cremation ground.* All dead bodies to be removed from the "*Hospital Bholios*" and from the stations, and sent here for thorough cremation: the company to supply sweepers and fuel. No corpses to be cast into rivers or canals, nor allowed to be cremated elsewhere. At sea matters are different.

XIX. Licensed Shopkeepers at Stations.—At these stations a sufficient number of licensed shopkeepers to be provided, with a supply of suitable food material under the strict supervision of the Medical Officer. To prevent swindling and exorbitant prices, which lead to starvation, etc., a *current market rate* to be drawn up by the station master in consultation with the local Inpector of Police and the Medical Officer. Every facility ought to be given passengers to have *at least one cooked meal in the twenty-four hours.*

SANITARY PROGRESS IN PURI.

BY C. BANKS, M.B.

Puri, situated on the south-eastern corner of the Province of Orissa, is the terminus of one of the most important pilgrim routes in India. It is essentially a Hindu city, having a resident population of 28,794 individuals, of whom only 300 belong to other religions.

It is yearly visited by thousands of religious devotees to worship at the shrine of Jagannath. During no part of the year is the town free from pilgrims, and this is a perpetual source of anxiety to those responsible for the health of the community. From its intimate connection with regularly-recurring outbreaks of cholera, few cities have received such prominence in medical literature, or been subjected to so much well-deserved abuse, because of the absolute disregard of the people for cleanliness or the conditions under which pilgrims were compelled to live.

Jagannath came into the hands of the British in 1803, but it was not till 1871 that any serious measures of sanitary reform were introduced. Previous to this the condition of the town was simply appalling, and the first Sanitary Commissioner for Bengal in 1865 wrote regarding it:—

> "Still the insanitary condition of Puri remain unabated, where, more than anywhere else in India, reform is needed. It would be almost impossible to conceive a place more destitute of all proper sanitary arrangements, no drainage, no conservancy, sewage contaminated wells, tanks charged with every animal and vegetable impurity. Arrangements for cremation and burial, as bad as they can possibly be, submerged streets, filthy lanes, generally over-crowded dwellings, innumerable cess-pits, neglected cowsheds, ditches and hollows unapproachable for their loathsomeness, such are (in simple truth and without a shade of exaggeration) the conditions under which many thousands of pilgrims are crowded together, suffering from malarious disease, splenic cachexia, dysentery, cholera, elephantiasis, syphilis, leprosy, and all the most terrible diseases known to man."

So recently as 1874 the pilgrims were made to drink copiously from a cistern (called Paduk Koond) which received the washings of the paved floor of the inner temple. This liquid was so foul and putrid as to resemble sewage, and contained sulphuretted hydrogen sufficient to blacken lead paper immediately it was exposed to it, and required 34 parts of oxygen per 1,000,000 to purify it. It is little wonder that to go on pilgrimage to Puri in those days was considered such a dangerous proceeding. It has been computed that the mortality amongst pilgrims in Puri alone was at one time 13 per cent., not to speak of the terrible havoc wrought *among them* on the return journey and *by them* throughout the length and breadth of the land. Nor is it difficult to believe in the correctness of this computation, judging from the amount of apathy and indifference to the welfare of pilgrims now exhibited by those who grow fat at their expense. I have known pilgrims attacked with cholera to be cast out of lodging houses, in order to save the owners of them the trouble of reporting the occurrence to the police, and I have known other cases in which the bodies of such unfortunate creatures have been discovered in the morning half-devoured by pariah dogs. I can fully endorse every word of Dr. Tull Walsh, formerly Civil Surgeon of Puri, who says :—

> "I could dilate on the cruelties and miseries to which pilgrims coming to Puri are subjected, and I could shew beyond doubt that the existence of such pilgrimages is in itself brutal cruelty before which the stories of the immolation beneath the wheels of the Jagannath Car pale into insignificance."

The first subject which received the attention of Government was better accommodation for pilgrims, and in 1871 the Puri Lodging House Act was introduced. The only agency employed to give effect to the Act was a superintendent, a mohurrir, and two chaprasies. The greatest prudence and caution had to be exercised, lest the people should regard the innovation as unnecessary interference with their former social habits and customs, and at first only those sections of the Act dealing with the trimming of trees, cleaning of cesspools, and the removal of rank vegetation were applied. Officers were frequently obstructed in the performance of their inspection duties.

A fair amount of progress, however, was effected, and on 1st April 1881, when the town was constituted a Municipality, the Lodging House Department bequeathed to it twelve *pucca* and five *kutcha* latrines—the nuclei of other important sanitary works, and has yearly ever since contributed liberally towards its conservancy. The Municipal and Health Offices work harmoniously together, and under circumstances and hindrances to sanitary progress, which perhaps exist nowhere else in Bengal, the condition of the city of Jagannath has assumed a somewhat improved aspect. The income of the Municipality has risen from Rs. 15,000 to Rs. 30,000 yearly (exclusive of a drainage loan from Government), of which no less than Rs. 24,000 are spent on sanitation. The conservancy establishment has risen from 66 mehters in 1875 to 172 at the present moment, exclusive of jemadars, while 2½ years ago a conservancy inspector was appointed to supervise it. Before the introduction of the Lodging House Act, public latrines were few and far between.

There are now 15 public and 583 private *pucca* latrines, and the number is being gradually increased.

Until quite recently one or more cess-pools adorned the plinth of every house, and the result was that the whole town stank with their foul emanations.

In 1893, 1,242 of these were converted into *pucca* drains for the exit of rain water, and 397 were converted into what might be termed "*detective receptacles.*" The nuisance can only be tolerated, in its mitigated form, in the absence of drains and proper means of flushing them, for many of the inhabitants cannot otherwise dispose of their ablution water. The subject of cess-pools is one of the most important in Indian hygiene, and might suitably and profitably be discussed by a body of sanitary experts.

The Pejnulla tank, which collects the rice water from the cook-house inside the temple, was regarded as a permanent nuisance as far back as 1871, and only those who have witnessed the evil results of this wretched sink of fermenting rice water overflowing into the streets around the temple can appreciate the improvement effected since. By a recent order of Government, the Civil Surgeon of Puri is ex-officio Chairman of the Municipality. The additional powers thus conferred upon him are powerful weapons for waging war against all manner of nuisances and render his duties as health officer much more interesting and responsible than heretofore. At the same time a vast amount of useless official correspondence is avoided.

DRAINAGE.—Over four miles of drainage have been laid down, and the system is being extended as funds permit, but owing to the low-lying ground on which the town is built, and its numerous narrow streets, the task is a difficult one ; several streets and lanes have been widened, but progress in this direction is greatly retarded by the value of property and the exorbitant demands made for the required land. There are now 9 miles of metalled and 13 miles of *kutcha* roads within municipal limits, all of which are kept in decent repair. Night-soil, formerly said to have been regarded as suitable for road-making and as wholesome food for cattle, is now disposed of in trenching grounds, most of which are under cultivation.

The hygienic condition of the temple and the food cooked and sold within it are now under the control of an Assistant Health Officer. The Mohaprasad, as it leaves the temple, can in no way be regarded as unwholesome. Unfortunately, however, the matter does not end here. Tons of the holy rice are carried away by pilgrims to their friends at home, and no matter to what extent it undergoes putrefaction on the journey, every morsel must be consumed, regardless of consequences. The traffic in Mohaprasad is entirely beyond our control, nor can we be reasonably held responsible for sickness caused by it beyond our jurisdiction. It is difficult to see what legal measures can be enacted to prevent this evil.

In olden times a typical lodging house was one which fulfilled all the conditions necessary for shutting out most completely fresh air and light. These times have gone, lodging house-keepers have come to realise the importance of providing substantial and well-ventilated rooms, and at the present moment there are few which could not stand the scrutiny of the most exacting sanitarian. In 1892 and 1893, 194 *pucca* latrines and 119 *pucca* drains were improved and constructed, 1,267 new windows were made and 1,662 old ones enlarged. These results were only obtained after the issue of 1,422 notices, and the suspension of 151 licenses. This will give you some idea of the extent to which the interests of pilgrims are guarded, compared with past times, and the success which has attended the introduction of the Lodging House Act. The want of accommodation, however, is still keenly felt, and up to date we have not been able to prevent overcrowding. At the dead of night during the car festival of 1893, when the *Nua Kalebar* or Re-incarnation of Jagannath took place, 399 pilgrims occupied the Jagannath Bullub Dharmsala, with an area of 6,694 superficial feet (the $\frac{1}{7}$th part of an acre), shewing a density of 2,793 individuals per acre. This represented only an item of the general overcrowding in the lodging-houses, streets and vacant spaces of the town. Compared with Puri during such important religious festivals, the density of Benares (101), Cawnpore (187), Agra (150) is insignificant. The accommodation provided varies according to the supposed auspiciousness or otherwise of the year for pilgrimage, and is to a large extent purely a matter of speculation based on the expectations of those who take out licenses.

WATER-SUPPLY.—The water-supply of the town is obtained from 52 public and 85 private wells. The sacred tanks, which are used only for bathing purposes, are as filthy as they are numerous. The worst of all and the most sacred is the Swetganga. It is said to have been in existence for over 700 years, and hold (in semi-solution) the concentrated essence of the filth of ages. In my experience no case of disease has been directly traceable to it, and its safety, I believe, lies in its foulness. Repeated efforts have been made to clean it, and large sums of money spent, but all to no purpose. Better far would it be in my opinion to have all such abominable sinks filled up. The wells of Puri afford no greater facilities for the growth of disease germs than wells in almost all other Indian towns dependent upon this source for their supply of water for domestic purposes. You may plaster and putty, provide parapets, pavements, chains and buckets, stick up threatening notices, as much as you like, but unless you change the natures and habits of the people, or provide them with a supply of drinking water which they cannot defile, the prevention of pollution, either directly by the introduction of dirty utensils, the washing of clothes and personal ablutions, or indirectly by percolation through the sub-soil, will be an utter impossibility. A water-supply beyond suspicion is desirable everywhere, and nowhere more so than in a pilgrim city, but how Puri Municipality, with an income of Rs. 30,000, which is found inadequate to meet its present requirements, can ever hope to be in a position to spend Rs. 3,50,000 on the provision of a new water-supply, and Rs. 17,000 yearly to keep engines going, is a problem whose solution is somewhat difficult. Such was the estimated cost of a scheme devised for Puri. When we consider to what a large extent the health of all India hinges on the health of Puri, the problem appears in all its true importance. It is one which cannot be neglected, and would be completely solved, as has been suggested in other quarters, by the re-imposition of a pilgrim tax and persistent collection, in spite of all protest, till the necessary sum is realised, or by liberal donations from those who can afford them, and who have at heart the interests of Jagannath and his pilgrim devotees. While a great deal has been done in attempting to eradicate the sanitary defects in Puri, the existing insanitary evils are all too numerous.

From 1887 to 1893, 3,603 births and 9,565 deaths were registered in the town, or three deaths for every birth during that period. In July, of the present year, 34 births and 213 deaths occurred, giving a birth-rate of 14·16 and a death-rate of 88·68 per 1,000 of the population. While English towns have been gaining something like 16 per 1,000 yearly, Puri has actually been losing according to the figures shown in the Sanitary Commissioner's tables for many years back 28 per thousand of its population, and yet instead of being swept off the face of the earth, it goes on adding to its numbers. If, further, we are to believe all that is reported, there must have been a time when the death-rate calculated on the same principle fell little short of 866 per 1,000. The absurdity is palpable and solely due to the fact that the death-rate amongst the resident and pilgrim populations is calculated on the resident population only, plus a handful of pilgrims who happened to be in the town when the census was taken. During the same period, 1887 to 1893, it is estimated that 635,000 pilgrims visited Puri, amongst whom 2,066 deaths from all causes occurred, giving a death-rate of 3·2 per 1,000. During the car festival of 1893, when 200,000 pilgrims assembled, the death-rate amongst them was only 1·7 per 1,000. The figures for very many years back, no matter how carefully analysed, compare most favourably with the figures before sanitary measures were introduced, and by putting 1·7 against 130, which represent the death-rate amongst pilgrims per 1,000 in present and past times, you gain something like an approximately correct idea of the decrease. Deducting the number of deaths amongst pilgrims from the total number of deaths, and calculating the death-rate on the aggregate population residents during those seven years, 1887 to 1893, the death-rate amongst the resident population has been approximately 36·4 per 1,000. Deaths amongst diseased beggars, of whom we have a very large share, and amongst old people who come to die in the Holy City (who are not regarded as pilgrims in the usual sense of the term), are potent factors in the causation of the heavy mortality amongst the resident population. I venture to assert that but for pilgrims and this class of people, our town in every respect would compare well with the healthiest town in the Province, in having the almost constant fresh sea-breeze from the Bay of Bengal. I venture further to assert that but for pilgrims our death-rate from cholera would be reduced to a very low figure indeed. In making those assertions, I have the support of my predecessors for the past twelve years, one of whom makes the following remark regarding epidemic outbreaks of the disease:—

> "The see-sawing movement is so striking that no one who has resided in the place for some time can fail to notice it."

During the past eleven years the highest number of deaths from cholera have been recorded in those months, when the three most important festivals were held, *viz.*, the Dole Jatra, the Rath Jatra and the Panchak. During those 11 years 4,262 deaths occurred, of which 3,802 or 89 per cent. occurred during those festivals alone, originating coincidently with the arrival of pilgrims and subsiding in a most definite manner with their departure. A reference to the figures of the current year prove this most conclusively. One death from cholera occurred in the town in May, none in June. There were 96 deaths in the district during June. None of these, however, occurred in any part of the district frequented by pilgrims. On the other hand, the disease prevailed in epidemic form along the pilgrim route on Jagannath Road in Balasore and Cuttack districts, affecting several of the villages at which pilgrims halted. On their way to Puri, 36 deaths occurred in the town and 882 in the district of Balasore. In the district, however, 310 deaths occurred. Batch after batch of pilgrims began to arrive in Puri, each with a sorrowful tale to tell of friends dying on the road, and of others being admitted into the various hospitals suffering from the disease. The result was that, on 3rd July, 11 pilgrims were removed to the cholera hospital in Puri; on the 4th, 19; on the 5th, 12; and on the 6th, 10. The disease then began to abate, one or two occurring on alternate days, till, finally, on August 1st, the town was free from the disease, pilgrims began to arrive again in large numbers at the commencement of the Durgah Poojah holidays, and on 4th October, during my inspection of Baliunta Dispensary, 14 miles from Cuttack and 39 miles from Puri, I was informed that the last of three pilgrims on their way to Puri admitted, suffering from cholera, had died that morning. On 7th October I received a telegram from the Assistant Health Officer, Puri, saying: "Outbreak since yesterday. Ten patients admitted into hospital. We have taken all precautions, pilgrims specially, Midnapore District."

Here again the town, which was free from the disease from 1st August till 6th October, was infected coincidently with the arrival of pilgrims, and out of twenty-six cases, which occurred from 6th to 19th October, not one was an inhabitant of the town, and with a single exception the first ten attacked had not been twelve hours in the place. One of them had only been three hours. Another was attacked on the way. If anything has been demonstrated to be a fact in Puri, it is that pilgrimages and cholera go hand in hand.

Quarantine or restraint are impracticable and impossible. Isolation is our chief stronghold and safeguard, and personally I believe that the immediate removal of the sick to the various hospitals, the disinfection of infected spots, the destruction of soiled linen and cremation of the dead has done more to prevent the dissemination of and to reduce the death-rate from cholera in the town and district of Puri than all the other sanitary measures put together. By the systematic notification of outbreaks of epidemic diseases wherever they occur to those concerned, in adjoining neighbourhoods, as has been lately recommended by the Sanitary Department of Bengal and Madras and organised co-operation in attempting to, as far as funds permit, still further improve the conditions under which pilgrims live during long and tedious foot journeys in the matter of food, water, halting stations, and hospital accommodation, we may disarm pilgrimages to Puri of many of their remaining terrors, and still further reduce the death-rate from cholera, dysentery and other diseases to which pilgrims are so prone. By this means only can we hope to redeem the evil reputation which pilgrimages to Puri have acquired.

ON THE DISINFECTION OF WELLS AS A MEANS OF COMBATING CHOLERA EPIDEMICS.

BY E. H. HANKIN, M.A.

It is now universally admitted by all bacteriologists who have studied the question that the cholera microbe is the cause of cholera. As this fact is a matter of great practical importance, it may be well to commence this paper by explaining a misunderstanding that has recently arisen in this connection. Sanarelli, Metchnikoff and other observers have, during the last two years, discovered in water microbes closely resembling the microbe of cholera. These discoveries have thrown doubt on the bacteriological test for the microbe of cholera propounded by Koch. This possibility that it may not be practicable to recognize the cholera microbe when it is present in the outside world, does not however throw any doubt on the relationship of the "comma-bacillus" to the disease. Similarly there is by no means complete unanimity as to the mode of causation of cholera epidemics. Just as every one will admit that mosquito-bites are caused by mosquitoes, though he may not be able to explain why mosquitoes are more common in one country or at one time of a year than another; so every one admits that the "comma-bacillus" is the cause of cholera, though he may not be able to explain why epidemics of cholera are more prevalent at one season than at others or in one place rather than in other localities. Just as with mosquito-bites, so with cholera epidemics, the explanation of their prevalence is in each case merely a question of the natural history of the organism concerned.

Whatever points in the natural history or biology of the cholera microbe may remain unexplained, one act appears to me to be fairly clearly proved, namely, that in the majority of cases the disease is caused by swallowing the microbe in drinking water. In the parts of India with which I am acquainted river water does not seem to be capable of transmitting the disease. This fact has been discussed in another paper read before the Congress. So far, therefore, as the North-West Provinces are concerned, we are left with the water of wells and tanks as the agents in the transmission of the disease. In the greater part the area referred to, only wells are used for drinking purposes. It becomes, therefore, a matter of great importance to be able to free wells from the cholera microbe. If the above-enunciated views are correct, it is difficult to understand how a cholera epidemic could go on, if the well water concerned in its production was disinfected. The discovery of a suitable disinfectant for this purpose is by no means easy, and the question is further complicated by the fact that a reinfection of the well is always likely.

In a paper recently published in the "Indian Medical Gazette" I described the use of lime for this purpose. It has the advantages of being cheap and non poisonous. The disadvantages are, *firstly*, that it is of no use unless it is absolutely fresh—a condition that it is impossible to ensure in many districts. *Secondly*, it kills frogs. These animals, which are almost universally present in wells, may be useful scavengers while they are alive, but the presence of their remains after their death is the reverse of desirable. Some cases have come to my knowledge in which the well water has acquired a putrid taste a few days after the addition of lime, probably owing to this cause. *Thirdly* (though this is only a theoretical objection), after the alkalinity of the water caused by the lime has diminished, it is likely to be a very favourable medium for the growth of the cholera microbe. In some experiments carried out with the object of testing this possibility, I found that the cholera microbe was more favoured (if other microbes were also preserved) by the presence of traces of lime as a means of rendering the medium alkaline than by the addition of any other alkali. Notwithstanding these objections, I have received the following reports from various Civil Surgeons who have used this disinfectant during cholera epidemics. Surgeon-Major Saunders writes from Unao that he used it on several occasions, and that it nearly always stopped the cholera; in cases in which this did not happen, the disease ceased after a second treatment. No details were however given. Surgeon-Major Saunders states that it is necessary to lower a man down the well before adding the lime to catch the frogs. Surgeon-Major Giles, of Bijnor, has used limes in several cases. He has only communicated to me the results of the first experiment. Here two wells in a village were treated. I do not know how many cases had already occurred, but only one other case happened after the addition of the lime, and this took place on the succeeding day, and so with little doubt had been infected before the addition of the lime. Surgeon-Major Giles regards the experiment as successful, but points out that at the time cholera was dying out all over the district. This implied caution appears to me to be necessary in every case in which lime has hitherto been used. I disinfected about twenty wells with lime in a district in Cawnpore, and no further cases occurred in the disinfected area. I feel very sceptical as to whether this result had anything to do with the addition of the lime. Surgeon-Major Tuohy, of Saharanpur, tells me that he used lime with success in a localised outbreak in a village near that town.

The disinfecting action of lime, and still more of other antiseptics, can only be temporary, and considering the constant opportunities of reinfection that must occur during most epidemics, it might appear to be futile to attempt to check the progress of cholera by such disinfection of wells. Therefore, before describing my further experiments, I propose to discuss the possibility that it may not be necessary to completely remove the microbe from the water, but that a change in the quantity of the microbe that is present or in its virulence may be in many cases sufficient to effect the object.

Of course in some cases it is known that cases of cholera appear within twenty-four hours of the infection of the wells. In other cases, on the contrary, it appears to me to be certain that the well water does not become infectious till several days or more have elapsed after the microbe has first gained access to the water. The first class of cases does not come into the present discussion. In favour of the second eventuality I may quote the fact that in some cases the disease appears to break out over a large area of country simultaneously, so rapidly and over so large an area that there is no time for its distribution to be accountable by human intercourse. Since "aërial miasms" are out of fashion, and since we can hardly suppose that the disease has originated *de novo*, we are, I imagine, obliged to suppose that in such cases some widespread condition, such as a rise of temperature, has enabled the cholera virus that previously was present in a latent condition to spring into activity. So far as I know in districts with which I am acquainted, the only place in which the cholera microbe is likely to lie latent in this way is in the village wells. So far as the microbe is concerned this is not so much a matter of theory as of fact; for, in the Balrampur district, on two occasions, I detected the cholera microbe in traces in the well water at a time when no cholera was present among the consumers of this water. Three days later I detected the microbe in quantities in the same water, and at or shortly after this time the disease appeared. Here it its clear that at a time when the cholera microbe was present only in small quantity, it was unable to produce the disease; when it had had time to reproduce, it was capable of producing infection. I suppose this is a simple question of quantity rather than of quality of the microbe. If this had occurred in other cases one would expect that some time would elapse between the time of introduction of the infection into the village and the appearance of the disease in epidemic form. On turning to a report on the subject of cholera in this district by Surgeon-Captain Pratt, I find that in the cases of one or two villages the events appear to favour this view. In other cases the disease appears to have broken out immediately after the introduction of the infection by returning pilgrims. But in the majority of cases no dates are given. In a report on cholera in another district, I find it stated that this simultaneous appearance of cholera over a large area is contrary to the water infection theory which may or may not be the case, but again no accurate details are given that might aid one in arriving at a solution of this unknown point in the natural history of cholera microbe.

Thus we see that there is reason for thinking that in some cases the cholera microbe exists in well water in a harmless condition for some time before the appearance of the disease. There is still more conclusive evidence proving that the cholera microbe continues to exist in a harmless condition for some time after the cessation of the outbreak. During the present summer I have examined a large number of specimens of water taken from wells in different localities during and after the time of a cholera outbreak. I owe my best thanks to Surgeon-Colonel Hutcheson, the Sanitary Commissioner, North-Western Provinces and Oudh, and to several Civil Surgeons who have from time to time sent me the numerous specimens of water used in this research. I found that for from one to three months after the cessation of the outbreak the cholera microbe was still to be found in the well water in a more or less degenerated condition. After this time it gradually disappears in the great majority of cases.

Thus it is evident that the cholera microbe is generally incapable of producing cholera. So far as the districts in which I have worked are concerned, this is not so much a matter of theory as a legitimate conclusion from a large number of facts that I have accumulated during the last two years. I have no doubt that some of my readers who may accept this conclusion will expect me to go on to discourse of "blue mists" or the "x," "y," "z's" of Pettenkofer and his school, or of unknown factors in a general way as being necessary in order to arrive at an explanation of a cholera epidemic. In this I must disappoint them. I have generally noticed that those who are most ready to talk of *unknown* factors in connection with cholera really use the word in the sense of "unknowable," or "inexplicable," and, as a rule, are ignorant of the facts of the biology of the cholera microbe. Of course it is impossible for me to deny that some unknown and hitherto unsuspected factors remain to be discovered before we arrive at an explanation of the facts connected with the spread of cholera. But it appears to me to be at least possible that the phenomena of cholera epidemics will be found to be explicable by means of factors of whose nature we are already aware in a general sense. For instance, turning to the results of laboratory experiments, we know that the cholera microbe is the most variable of microbes, and in no way is this fact more clearly shown than in its virulence. I have recently found that in different epidemics in the North-West Provinces the cholera microbe shows widely different degrees of virulence. Cholera microbes from the Allahabad *méla* which afterwards spread throughout the provinces killed guinea-pigs in 4½ hours. These, from a restricted epidemic in Shahgunj, an epidemic that showed no tendency to spread into neighbouring districts, were only capable of killing these animals in about 17 hours. Another factor known to be of importance with respect to the production both of choleraic peritonitis in animals, and less certainly of true cholera in animals, is the quantity of the microbe that is introduced into the system. That this factor has to do with the production of the disease in man is, I consider, rendered practically certain both from the analogy of these laboratory experiments with cholera in animals, and from the analogy of other diseases in man. A direct experiment in favour of this view may be quoted from the history of the Altona outbreak. Here the water-supply consists of the Elbe water filtered. During the cholera outbreak in Hamburg, the adjoining suburb of Altona remained comparatively free from the disease. At this time the Altona water contained on an average 50 microbes per cubic centimetre. A few months later, however (owing to the frost), there was a partial breakdown of the filtering apparatus, and a small epidemic resulted. In consequence of this breakdown, the number of bacteria in the water-supply rose to about 1,000 per c.c. There is no doubt, I think, that during both periods the Altona water contained the cholera microbe, but only when the numbers increased, and not before, was this water capable of producing infection to any great extent.

Among the factors which determine whether the cholera microbe in a well will produce an outbreak, it occurred to me that the quantity in which it is present would be the one most likely to be capable of being influenced by artificial means. So far as I know the quantity of the microbe that is likely to be present in the days succeeding infection of a well, is likely to depend as much as anything on the quantity of food materials that are dissolved or suspended in the water. "Food materials" in this sense is another name for organic matter, and the latter is known to be capable of being destroyed by permanganate of potassium. The use of this substance for cleaning wells is by no means new. Its employment is recommended in Parkes' Hygiene, but I am not aware of its having been systematically employed in combating cholera epidemics. I may here state that I do not consider that I have obtained proofs that it can be profitably employed for this purpose, but I think that the results of the following experiments are such as to justify an extended trial of this substance in cholera outbreaks.

Ten ounces of permanganate of potassium were carefully dissolved in the water of a large well. This quantity was in the proportion of one part of permanganate to 40,090 of water. The following table shows the effect thus produced on the microbes present : –

	Number of microbes per cubic centimetre.
Before adding permanganate	20,000
One hour after ,, ...	480
2 hours ,, ,, ...	360
3 ,, ,, ,, ...	296
4 ,, ,, ,, ...	120
5 ,, ,, ,, ...	160
26 ,, ,, ,, ...	26
27 ,, ,, ,, ...	36
29 ,, ,, ,, ...	20
48 ,, ,, ,, ...	98
72 ,, ,, ,, ...	136
144 ,, ,, ,, ...	256
168 ,, ,, ,, ...	528
192 ,, ,, ,, ...	about 60,000
216 ,, ,, ,, ...	,, 60,000

The sudden increase in the number of microbes observed in the last two experiments may be taken as an indication that an increase in the quantity of organic matter that was present had occurred. What this was due to is of little moment. The importance of the observation consists in its showing that the number of microbes present can be greatly influenced by the addition of permanganate. The influence of this addition was exerted for at least six days. The well however was not in use at the time.

It will be noted that this "starving out" of the microbes was only partial. It may be doubted whether it would be so well marked in a well that is in use, and therefore liable to all sorts of contamination. The cholera microbe belongs to a family of bacteria that are known to be better fitted than most to live and reproduce in very diluted media. Is it not then likely that the permanganate will have a tendency to starve out other microbes, leaving that of cholera relatively unharmed? That this eventuality does not happen is shown by the following observations made in the Balrampur district.

The bungalow in which (owing to the kindness of Colonel Anson, the Political Agent) I was staying during my visit to this place was situated a few hundred yards from the village of Dhusaha, in which cholera existed at this time. I visited this village

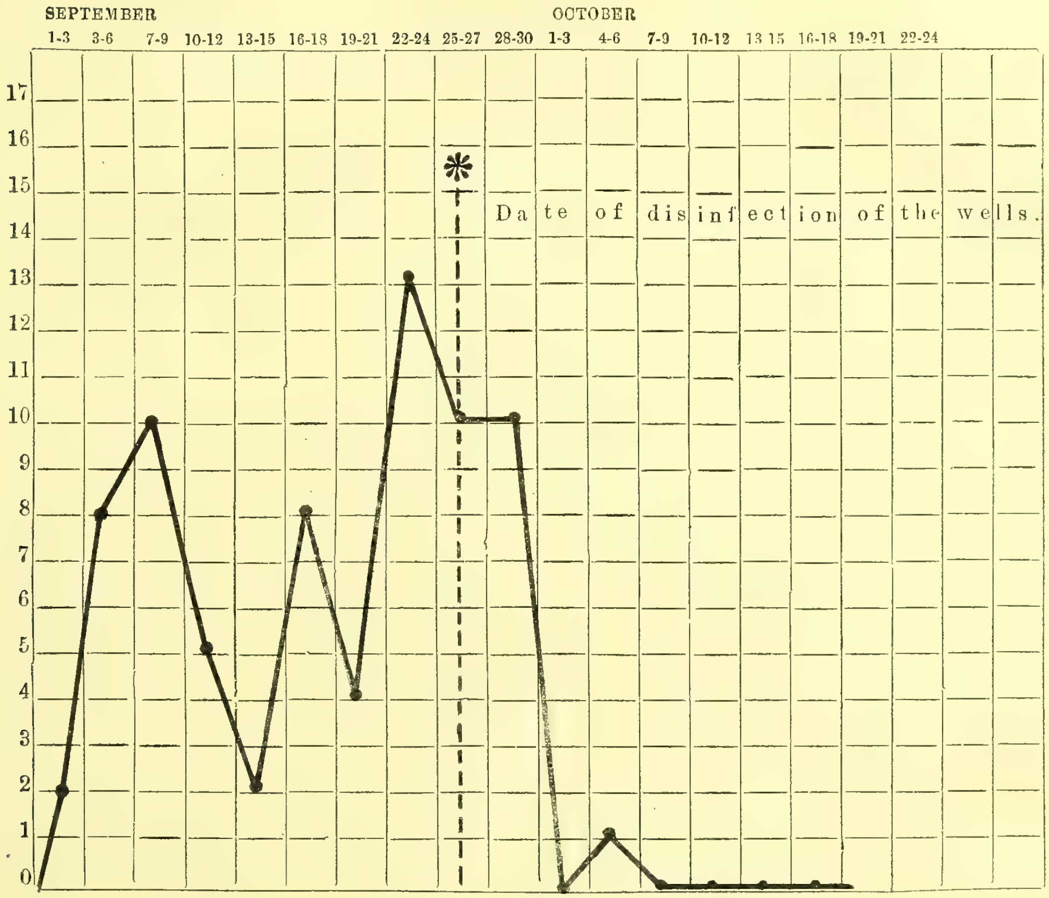


Fig. 1.—Curve showing attacks in cholera epidemic in Dhusaha, in three-day totals. One other case occurred after the disinfection of the wells, which is not shown, as water from a neighbouring village is known to have been used.

Total number of inhabitants	320
" " attacked	74
" " deaths	38

every day during my stay, and made a large number of bacteriological observations there, of which the following table gives a summary :—

Name of well.	Number of microbes per c.c.	Presence of the cholera microbe.
1. Mahbeer Pundit Well	3,500	Present.
2. Pundit Bhawani Pershed well	3,500	Not detected.
3. Mahadeo Purhit well	23,000	Present.
4. Bal Krishn well	7,000	Present.
5. Tank surrounded by refusé heaps	2,700	Not detected.

With the exception of one other tank this list exhausts the water-supply of the village.

Each of the wells containing the cholera microbe was treated with permanganate. In each case about an ounce of permanganate was placed in an iron "dhol." The vessel was lowered into the well, filled with water and drawn up. The water was poured back into the well, leaving the residue of the permanganate at the bottom of the "dhol." The process was repeated till all of the salt had been dissolved. The water in the well thus acquired a pronounced pink colour. The addition was made at sunset in order to occasion as little inconvenience as possible to the users of the wells. So great was the quantity of organic matter present in the water, that in each case the colour had vanished on the following morning, and the water was ready for use without its being necessary to pump any out. In the case of the first well on the list, three days after treatment the number of microbes present in a cubic centimetre, had only fallen to 1,600. Nevertheless, the microbe of cholera could no longer be detected. Similar results were obtained with well No. 3. Here the examination was made on the same day as that on which the permanganate had been added, and the number of microbes present was found to be 1,450, but the cholera microbe had vanished. In the case of well No. 4, the number of microbes present was found to be 2,500 on the third day after the addition. The cholera microbe was also in this case no longer to be detected.

As to the effect of this disinfection on the epidemic, all that can be said is that it may have caused the ensuing cessation of attacks *(See Figs.)* Ten cases of cholera occurred on the second and third days after the treatment of the wells had been completed. Considering that the cholera in this village was of a somewhat mild type, one would expect that the incubation period would be at least two or three days, and that consequently those last attacked were infected before the disinfection of the wells. Besides these there was one other case a day later that is stated to have drunk the water of the disinfected wells. I have not been able to obtain accurate details as to the number of those attacked who had drunk this disinfected water. But of those who died, at least four had used water from wells in a neighbouring village where the water had not been treated.

This village was inhabited entirely by Brahmins and Hindoos of other high castes, who only eat food cooked by themselves. Their diet consists almost entirely of "dhâl-bhât." They eat no sweetmeats bought from a bazzar, and very little similar food that is so attractive to flies, and as a matter of fact at this season of the year—September—very few flies were about. The village was small, with a little over 300 inhabitants. There was relatively little use made of the wells. For all these reasons it is likely that the water and nothing but the water had to do with the cholera, and that very little reinfection of the wells was likely to occur.

My next observations on the effect of permanganate were made in Shahgunj, where a very different state of affairs exists. This place is a suburb of Agra. It is inhabited by Mahomedans and Hindoos of various castes, who often eat food bought in the bazaar, and who are not so particular as to the cleanliness of drinking vessels as Brahmins. Consequently, the cholera microbe has every facility in getting from one well to another. A very short time after cholera was imported into the place on a recent occasion, the cholera microbe was found in nearly every well in the place. Further, though in each case a few hours after the addition of permanganate the cholera microbe was no longer to be detected in the well water, it had again reappeared on the following day. This fact is most easily explained by supposing that a reinfection of the wells had occurred. In the case of this epidemic I treated half the wells with permanganate and left the other half untreated as a sort of control.

The results are contained in the following table which requires some explanation. There is no direct means at my disposal for estimating the number of cholera microbes present in water. In the following experiments I tested for the cholera microbe in the usual way by adding some peptone to the water to be examined. On the following day (in some cases on the second day also) the mixture was microscopically examined. Owing to the favourable influence of the peptone, the cholera microbe, and to some extent other microbes, will in the meantime have increased greatly in numbers. The quantity of the cholera microbes visible relatively to other microbes will depend, *firstly*, on the original proportion of this microbe that was present originally; *secondly*, on its vitality *vis-à-vis* to other microbes. In the case of a series of observations of the same water, the latter factor may probably be taken as constant. When I say that a large number of cholera microbes were found in the water, I really mean that a large number of this microbe was visible in a peptone culture made from this water. That there was in reality a large number in proportion to other microbes in the original water is merely a probable assumption which must be borne in mind in interpreting the following table. In cases in which a nearly pure culture of the cholera microbe was found on the following day, I have written the number 4. If a fair sprinkling of other microbes was present, I have employed the number 3. If cholera and other microbes were present in about equal numbers, I have written 2. The number 1 is written in cases in which it could only be detected with difficulty, and 0 in cases in which it was not detected at all.

In the following list I have only included wells that can fairly be described as moderately dirty. One very dirty well from which the permanganate failed to remove the cholera microbe is not included. Certain very clean wells in which it did do this are equally not mentioned. In this case about two ounces of permanganate were added to each well. On the following morning *bhistis* were employed to pump out the water till a red colour was no longer observable. At this time in each case the cholera microbe had vanished from the water. This result is not included in the table, but only the result obtained on the following day when it had reappeared.

FIG. 2.—*Attempt to disinfect Shahgunj Wells.*

NAME.	Oct 9t	Oct. 10th	Oct. 11th	Oct 12th	Oct 13th	Oct 14th	Oct 15th	Oct. 16th
A.—DISINFECTED.								
(1) Takir	1 K	1	...	..	...	...	...	...
(2) Koli	3 K	2	1	...	...	...		...
(3) K sri	1 K	2	1	...	...	...	..	1
(4) Bhogri Mull ...	3	4 K	3	...	...	1	...	...
B.—NOT DISINFECTED.								
(1) Jogi Walla ...	4	1	...	2	3	1	1	...
(2) Sayer Walla ...	2	...	...	2	2	1	1	1
(3) Mahomed Fusl ...	2	2	...	...	2	...	...	2
(4) Anar Walla ...	.	1	...	...	1	...	...	1

N.B—The numbers refer to the relative numbers of cholera microbes that appear to have been present.

4 indicating a maximum and O meaning that none were detected

K indicates the date on which permanganate was added.

It will be seen that in the case of wells that had been treated with permanganate, in every case there was a gradual diminution in the number of cholera microbes found, while, at the same time, the cholera microbe remained in apparently undiminished quantity in each of the wells that had not been treated with permanganate.

This diminution and ultimate vanishing of the cholera microbe in the treated wells took place at a time when not only was there no permanganate present, but even at a time when none of its soluble decomposition products could have been there, owing to the large daily consumption of the water. I know no way of explaining this but by supposing that some condition or pabulum necessary for the life of the cholera microbe had been removed by the action of the permanganate.

The permanganate appears to merely hasten a process that occurs more slowly by itself, for a month after the last observation recorded in the table the cholera microbe had vanished from every well in the place.

The small epidemic that existed at the time of my observations in Shahgunj, ceased at about the time I treated the wells.

Besides my own observations on the effects of permanganate I can quote experiments carried out by others which have had analogous results. Surgeon-Major Giles has used it in Nagina and the neighbouring villages. I do not know what effect it had on the cholera that existed at the time, but in every case, with one exception, the cholera microbe was detected in the specimens of the well water sent to me before but not in those sent after the addition of the permanganate. Surgeon-Colonel Martin has similarly used it with success in a well in Lucknow cantonments, and in another in Bareilly.

It appears to me that the above facts, while not enough to prove the utility of permanganate in cholera epidemics, are amply sufficient to justify an extended trial of this substance. From what has been said above, it will be understood that I scarcely expect the process to be of much use in cases in which the microbe possesses an exceptional degree of virulence. Neither do I expect it to be of use in cases in which water infection plays a subsidiary part in the spread of cholera, which I at present believe to be more frequent in India than is at present suspected.

It may be well to point out that owing to the fact that cholera has an incubation period, probably in most cases of two or three days, it is not likely that the use of permanganate will cause an immediate cessation of the epidemic.

Further, it is scarcely probable that the results of its employment will ever be sufficiently marked for it to be possible to draw a definite conclusion as to its value in a single outbreak. Therefore I hope that all who experiment with this substance will let me know the result, irrespective of the fact that by itself a single result may not appear to be sufficient to prove the point. It is only by means of an accumulation of observations that we can hope to come to a definite conclusion.

The cost of cleaning wells by means of this substance ought to be trifling. Its price in England is a shilling a pound, and an ounce is, I believe, sufficient for an ordinary well.

DISCUSSION.

Jogendra Nath Dutta (Calcutta) said he might suggest the addition of alum to the permanganate process advocated by Mr. Hankin. He stated that he believed that boiling the water after removal from wells was a greater safeguard than any disinfection where there is every liability to reinfection.

MAHAMARI, OR THE PLAGUE, IN BRITISH GARHWAL AND KUMAON.

BY G. HUTCHESON, M.D.,

Brigade-Surgeon Lieut.-Colonel, I. M. S.

1. The plague, *pestis septica*, Syrian, Levantine or Egyptian plague, the bubonic plague of Western China, and golâ or *phutkiya rog* and *mahamari* of British Garhwal and Kumaon are doubtless one and the same disease, which has existed in all probability in the hill tracts of India and China from time immemorial.

2. The disease, so far as history records, was prevalent in Europe in the sixth century B.C., and is said to have spread at this period over the greater part of the habitable globe ; and since then it has been recorded in Syria, the Levant, Egypt and elsewhere. Dale Ingram published an historical account

of the disease as far back as 1755. Moscow was the scene of an outbreak in 1770, and in 1813 the disease prevailed at Malta, and in 1834 at Cairo.

In India the disease has ever had a home, and prevails off and on, till the present day, in British Garhwal and Kumaon. In 1813 the plague was present in Central India and Rajputana, Kutch and Kattywar, and was first noticed at Kumtakole, and spread throughout Wagar during January, February and March 1816, and by the end of that year had extended to Scinde, where the mortality was great. The disease was still prevalent in Central India in 1819, and disappeared in 1821. Nothing more was heard of the disease in Central India till July 1836, when it broke out at Pali, a town of Marwar, whence it spread to Jodhpore. It prevailed at Deoghur in Meywar in March 1837, and thereafter extended to Jalia and Ramghat in the district of Ajmere. The disease all but disappeared towards the end of 1837, but in November of that year it again broke out in epidemic form at Pali, and continued till February the following year.

It is more than probable that the plague was introduced into Pali and Rajputana in 1837 from the Levant, as the "Chhipis," who printed the pieces of plain cloth brought from the coast from Bhownagar and Surat, were the first affected.

3. The Himalayan districts of the North-Western Provinces in which the disease occurs comprise :—

(1) Garhwal, bounded on the north by Tibet, on the east by Kumaon, on the south by Bijnor, and on the west by Tehri and Dehra Dun ; and

(2) Kumaon, now divided into two revenue districts, Almora and Naini Tal, bounded on the north by Tibet, on the east by Nepal, on the west by Garhwal, and on the south by the Tarai.

These contiguous districts lie between north latitude 28° 14′ 15″ and 31° 5′ 30″, and east longitude 76° 6′ 30 and 80° 58′ 15,″ and embrace an area of 11,038 square miles.

4. The population numbers close on 1,000,000 souls, with an average of 72 to 76 persons to each square mile, living at elevations from 1,500 to over 11,000 feet above sea level. For practical purposes the entire population may be classed as Hindu, as very few Musalmans, etc., are natives of the hills. The greater proportion of the population live at from 3,000 to 6,000 feet above sea level overlooked by the crowning peaks rising from 20,000 to over 25,000 feet of the great Himalayan range.

5. Outbreaks of the plague in these Himalayan hill tracts, the most mountainous in the world, are of two kinds :—

(1) Spontaneous outbreaks;
(2) Outbreaks caused by importation of the disease.

Spontaneous outbreaks are frequently associated with, and sometimes preceded by, a great mortality among rats, mice and other rodents, etc.

6. The plague or pestilence of the hill tracts is distinguished from all other fatal febrile malignant diseases by its extreme virulence, rapid course, fatality, and by the enlargement of the lymphatic (inguinal, axillary, cervical, etc.) glands,—the characteristic lesion of the disease when death does not ensue within the first three days from extreme virulence and direct shock of the great nerve centres. It has the shortest period of incubation probably of all known diseases, and it may prove fatal within twenty-four to forty-eight hours after exposure to infection, and there is clear evidence that the disease is communicable from the sick to the healthy.

7. The disease appears ever and anon in villages or hamlet situated "on precipitous mountain sides, in gorges reached only by means of a cradle swung on a rope above a boiling flood of snow water low down in a hill valley, in secluded spots reached by dubious pathways winding up a wooden glen starting from the river far below, on upland slopes close to the sources of a river formed by a waterfall, in secluded places, wilder it would be hard to find in all the hills, reached by a footpath winding over a high mountain and near where the Margari stream arises in a cuplike valley surrounded by high mountains, on a spur hillock-shaped, on the slopes of opposing mountains, on hills of moderate height, in bends of a river hemmed in by the hills, on three sides of the brow of a hill which stands out from the mountain behind it, on the slope of a great mountain overlooking the valley in which the river runs, on green hillocks backed by high mountains, and on a spur of rock jutting into a narrow valley," overlooked by the highest Himalayan peaks capped with the eternal snow. Here, where the atmosphere and climate are the finest and purest in the world, and at heights where the germs and microbes of disease are kept within narrow sphere, exists a disease which, in its infectious nature and fatality, surpasses all others in virulence, and ever threatens to break bounds and spread and be disseminated far and wide as in past times throughout Christendom. Cholera spares some of the household, but the plague often reaps each one of the many members of the upland home. So dreaded is the disease, that family ties in its presence are suddenly broken, and the father and mother flee from their children and abandon each other, seeking the lone mountain side in despair for a time of all human association.

8. The earliest record of the disease in the hill tracts is embodied in a report, dated 25th April 1836, by Mr. Gowan, the Commissioner of Kumaon, in which it is stated that *mahamari*, which was thought communicable by contact with articles in use in an infected tract, first appeared at Kedarnath in 1823. It originated, it was affirmed, in the person of the Rawal, the high priest, of the celebrated temple there, who, having in that year deviated from the rules prescribed in the *Shastras* for the performance of the religious ceremony called the "Hom," was smitten with this new form of disease and died, together with the Brahmans who assisted at the offering. From

Kedarnath, the disease spread to the villages in religious assignment to the temple, and afterwards appeared in other parganas of Garhwal. Others said that the disease came into existence for the first time at the Hardwar Fair.

9. In 1834-35 the appearance of the disease in the parganas of Nagpur and Badhan Garhwal was preceded by a great mortality among the rats in a village. The disease was characterised, it is stated, by fever terminating fatally in two, three or four days, and associated with an eruption of buboes or swellings.

10. During 1837 the disease was alarmingly prevalent in the pargana of Badhan along the higher parts of the Pindar river, and in 1846-47 it found its way to the sources of the Ramganga, and almost entirely swept away the population of Sarkot, situated at 7,000 feet on a high easterly spur of the great mountain Duder Katoli in patti Lobha, and also to a village near the source of the Kosi in patti Borarau, Kumaon proper. In 1847, a village, 15 miles west of Almora, situated among the pine forest of Siyahi Devi range was attacked, and in the latter end of 1848 a few villages along the fatal line of the Pindar river were threatened with a return of the disease. During the rainy season of 1849, it broke out with great virulence in patti Chaprakot, parganna Chadpur, and proved very fatal in the villages of Marora and Dadoli, and the Senior Assistant Commissioner of Garhwal, Mr. Strachey, now Sir John Strachey, in a report, dated 22nd December 1849, gave particulars of the outbreak. Mr. Strachey writes: "For about thirty years past there has existed in Kumaon and Garhwal a disease known by the local name of *mahamari*, apparently identical with the plague of Syria and Egypt, the characteristic symptoms being violent fever of the most contagious nature, always accompanied with swellings in the armpit, the disease ordinarily seeming to reach its crisis on the third day."

11. Dr. Renny, on the 9th May 1850, commenced a local investigation into the disease at Dadoli village, patti Chaprakot, and saw two cases on the 10th and two more cases on the 13th. He described the disease as an infectious fever of a malignant kind and of a typhus character, accompanied by glandular tumours, and generally terminating in death in three or four days. The mortality from the disease in 1849-50 was 113 in nine villages.

Mahamari was again prevalent in 1851, and in a joint report on the disease, dated 1st December 1851, by Dr. Pearson and Sub-Assistant Surgeon Sri Nath Mukerji, it is described as a typhus fever of contagious and infectious type. In a subsequent report, however, dated 17th May 1852, on the continuance of the disease into April and May, these officers, after extended observations, recorded the opinion that the disease was plague, associated with characteristic glandular swellings and distinctly contagious in its nature. It still existed in August of that year. There was an ascertained total of 633 deaths during the epidemic of 1834-35, and in 1851-52, 567 deaths were recorded in 77 villages.

In 1852-53, Drs. Francis and Pearson were actively engaged in the investigation of the disease and recorded the *post-mortem* appearance in four cases, of which the principal were congestion of the brain, a diseased condition of the blood, and effusion into the serous cavities.

12. *Mahamari* descended to the plains as late as 1853. In that year it appeared in an epidemic form in the towns of Thakurdwara and Afzalgarh, and in the district of Moradabad. Dr. Steven, Civil Surgeon of the district, reported on this outbreak in the plains. "It seems," he states, "that in December 1853, Ali Bakhsh, a resident of Mehidpur, a village in the Bijnor district between Thakurdwara and Afzalgarh, where the disease was prevalent at the time, went to the latter town to see a *nautch*; that he returned to his home in Mehidpur; and that three days afterwards his brother Muhammad became ill and died on the third day of his illness. Ali Bakhsh's cousin also took ill and died in three days, having had, as described to me, swellings of the glands in the groin. Ali Bakhsh's wife and sister living in the same house also died." Dr. Steven attributed the origin of the disease to contagion brought by Ali Bakhsh in a latent form from Mehidpur. Dr. Steven referred to the fact that *paharies* brought down goods for barter to Chilkia, a very important mart near Kashipur, and surmised that the disease was introduced by hill people, in intimate intercourse with the people of the district.

The disease was very prevalent also in Kashipur early in 1853, and lingered in the Moradabad district till 1854. Dr. Steven saw a few cases which were characterized by high fever and swelling of the glands of the right groin or of the armpit. It also prevailed in Rampur at this time; and it is stated that about 8,000 deaths occurred from the disease.

Dr. Steven's conclusions were:—

(1) that *mahamari* is identical with the uncomplicated or simple form of glandular plague as found in Egypt;

(2) that it can be conveyed to any town by contagion, and be propagated by endemic causes, as filth, bad ventilation, poverty and uncleanliness of the inhabitants.

13. In September 1859 *mahamari* again broke out in the northern parganas of the hill tracts, and in 1860 it was noted that close upon 1,000 persons had died of the disease.

An outbreak of the disease occurred at Sarkot on 20th September 1870, and continued till the 9th of November.

14. Dr. Richardson in a report, dated 4th October 1875, on *mahamari* at Siti, patti Danpur-Bichla, after stating that the last of six cases occurred on 9th September, says that "the first victims were a little girl, aged 8, and her father Kusalli, aged 30. They were attacked about 1,000 feet above the village of Siti and near the edge of the oak forest. Both were seized with fever, vomited once or twice, had large swellings in the groins, and both died on the fifth day after seizure. The bodies were thrown into a stream below. On the

day the bodies were disposed of, two other persons, living in the same building, were attacked after disposing of the bodies, and remained at Siti. They were taken or sent into the jungle and died there, and were buried where they died; but their graves must have been shallow for their bones were afterwards found scattered about. Thus, of the six deaths, four were among persons occupying the same building. The two last were Gujuali, aged 45, and Dhanali, aged 45, husband and wife. The next victim was a man 28 years of age. He had severe fever for two days when large swellings were observed in the armpits. He vomited twice during the illness like others. He died on the fifth day, and his house was burnt and the body with it. The last who died was a boy, Mulaki, son of Dharam Singh. He was taken ill and died about a mile from Siti in the jungle.

Dr. Pearson in a report, dated 22nd June 1876, states that he inspected villages in patti Bisaud, where fifty deaths from *mahamari* had been reported.

15. In November and December 1876 the disease was prevalent in certain villages in Kumaon and prevailed in Balt and Bintola within four miles of Almora and within five miles of Ranikhet. Dr. Planck inspected forty villages affected by the disease, and recorded 277 deaths, and confirmed the opinion that the disease was the *pestis* or plague of medical writers, and was readily communicable from the sick to the healthy. The villages included nine in pargana Khas Parja, twelve in Bora-ki-Rao, two in Attargoli, and seventeen in pargana Dhanpur, as follows:—

Parganas.	Villages.	Parganas.	Village.
Khas Parja ..	Balt.	Attargoli ..	Bhandargaon.
	Bintola.		Dugorá.
	Sirar.		
	Nainoli.		
	Gajula.	Danpur ...	Parsáli.
	Salla.		Sungárh.
	Biraura.		Baret.
	Maichor.		Nankori.
	Matoli.		Sama.
Bora-ki-Rao ..	Banuri.		Bandhar.
	Tanda.		Gaula.
	Sajoli.		Bhamangaou.
	Phalianti.		Dor.
	Ohain.		Chachena.
	Behta Talla.		Birtang.
	Kausani.		Darkot.
	Kajuli.		Alam.
	Mangalta.		Bothi.
	Ajula.		Basankot.
	Tailihat.		Kasiabara.
	Kururah.		Gadera.

Return of deaths from mahamari, 30th June to 16th July 1877.

District.	Pargana.	Patti.	Village.	Number of deaths reported			
				Men.	Women.	Children.	Total.
Kumaon ...	Baramandal	Athagali ..	Bhandergaon	..	...	2	2
	Danpur ..	Danpur Talla	Gadera ..	1	1	..	2
			Total ..	1	1	2	4

The Commissioner of the Kumaon Division, writing under date the 19th July 1877, says the recent epidemic seems to have come to an end, and states that the area affected has been in Garhwal the parganas of Nagpur, Chandpur, Budhan Chandkot, and Dewalgarh, and in Kumaon the parganas of Danpur, Johar and Baramandal, the total deaths up to date being 535:—

District.	Men.	Women.	Children.	Total.	Remarks.
Kumaon.. ..	105	69	64	238	Last report, 20th June, 1 death.
Garhwal ..	199	73	25	297	Ditto 9th July, 5 deaths.
Total ..	304	142	89	535	

Return of deaths from mahamari, 3rd April to 14th May 1878.

District.	Pargana.	Patti.	Village.	Number of deaths reported.			
				Men.	Women.	Children.	Total.
Kumaon ..	Baramandal	Khasparja ..	Bhulyara ..	3	3	..	6
	Ditto ...	Ditto ..	Bintola ..	1	2	1	4
			Total ..	4	5	1	10

16. Dr. Richardson reported that typhus fever, identical with *mahamari*, prevailed more or less throughout the year 1884 in the Kumaon Division, and in 1885 he visited certain villages, Sirka, Rung, &c., in patti Chaudans, pargana Darma, where the disease had been prevalent.

17. In 1886, the same officer visited villages in patti Giwar, pargana Pali, in which thirteen deaths took place from the same cause, and was informed on 13th October that ten persons had died of *mahamari* in Seri Danpur. He noted also that "a great number of deaths from *mahamari* took place in Garhwal during the year 1886." Dr. Thomson also reported on the outbreak of *mahamari*, identical with typhus fever, in April and May 1886, but the reports of these outbreaks are very meagre.

On the 28th March 1887, the disease was reported at Khatiari adjoining the military station of Almora; on the 5th April, at Gonja Jali in Bhabar Chhakata; on 27th May, fourteen deaths were reported from Bijapur village, patti Dora Mulla, pargana Pali, and on 14th June, three deaths in Nakutta village, patti Tikhum Mulla. The Collector of Kumaon on the 11th October 1887 gave a summary of deaths from *mahamari* in Danpur, as follows:—

Date.	Name of village.	Number of deaths.
24th August to 27th September	Dasauli in Pungraun ..	31
30th September	Lohathal do. ..	3
4th to 29th September ..	Surkali in Nakuri ..	7
25th to 30th " ..	Ghali	3
	Sungroli	1
	Total ..	45

Dr. Thomson, who reported on this outbreak on 13th June 1888, states that the first case at Dasauli occurred in the person of one Gungia Patak, who, it is stated, recovered.

The first case noted in the neighbouring village of Lohathal, on the 18th September, was in the person of a resident of Dasauli. A second case took place in the same house, in which two more persons died in October. An outbreak occurred at Gangoli, Kumaon, on the 4th October.

Under date the 24th October, the following deaths from *mahamari* were reported :—

Date.	Name of village.	Number of deaths.
8th October	Lohathal in Pungraun ..	1
9th ,, ...	Dasauli do. ..	10
15th ,, ...	Surkali in Nakuri ..	1
15th ,, ...	Dhari ,, ..	1
	Total ..	13

On the 2nd November five more deaths had occurred from the disease in Dasauli, and on the same date four deaths in pargana Chaugarkha, Salan Talla. On the 19th November fourteen deaths from *mahamari* were reported between 24th and 31st October in Dasauli village patti Pungraun, pargana Danpur; and on the 5th December *mahamari* had again made its appearance, one death being noted in Surkali, patti Nakuri, pargana Danpur.

On 29th March 1888, two fatal cases were noted in Kaurea near Dasauli, and on 5th April a woman died of the disease in Khitauli, and on 8th idem the husband of the woman died. On the latter date a boy died in Lohathal. The house in which former cases had occurred had stood empty for some months, the owners living a short way off in *chappars*. But this boy knew of the existence of "*gur*" in, and was observed taking some from, the house. On May 9th two deaths occurred at Singor.

A death from *mahamari* in village Lagor, patti Pungraun, was reported on the 15th May 1888; and the disease was said to be present in Uskot and Rithagarh, pargana Chaugarkha, at same time.

Dr. Thomson in his report of the outbreak states that the disease was *mahamari*, *gola rog or phutkiya*, hill plague, or a severe type of typhus fever highly contagious and bred and fostered by filth. On the 13th September 1888 a statement was furnished by the Senior Assistant Commissioner, Garhwal, showing that five deaths from *mahamari* had occurred in Nagpur, and sixteen in Dewalgarh mortuary circles, five in Badhan and two in Nagpur.

18. The history of the disease in its incidence among the people of the hill tracts from 1887 onwards is imperfect, owing, it is presumed, to the confusion arising from adopting the view that *mahamari* and *sanjar*, or typhus fever, were identical diseases.

19. No cases of *mahamari* were reported in Garhwal or Kumaon in 1889 or 1890. In 1891 six deaths from the disease occurred in patti Karakot, pargana Badhan between 27th June and 21st July (two deaths in June and four in July). The record is blank in 1892.

20. In 1893 two limited but associated outbreaks of *mahamari* occurred in July and September, in mauzas Surkali and Suni, patti Nakori, pargana Danpur, a few miles off the Bageswar-Berenag road, and about two marches from Bageswar.

The first outbreak occurred on the 8th July, and the second on the 13th September, and these outbreaks were associated, and each case was connected with some other preceding case or cases.

The extremely infectious and fatal nature of the disease is evidenced by the fact that it was communicated direct from the sick to the healthy, and that all those attacked died.

The affected families in both outbreaks occupied houses situated in a large gently sloping horseshoe-shaped valley, at an elevation of about 6,000 feet above sea level.

The houses in the locality are dotted round the upper margin of an extensively cultivated and terraced area, and form no collection that can be called a village.

The families affected were comparatively well-to-do people, and poverty or destitution had nothing to do with the outbreaks. The site and natural surroundings of the dwellings are exceptionally healthy; and the families undoubtedly lived in a naturally and exceptionally healthy climate, *but under conditions which favoured the onset and dissemination of zymotic disease in its most intense form.*

These two families occupied the end rooms of an isolated block of three houses, the centre house having remained empty for the previous six months, and the families had been resident in Surkali for years.

The first case occurred in the person of a girl, whose father, it is stated, died seven years before of the same disease; and of the two whole households of Kuna Sah and Ratan Lal, which were affected, all the members, numbering eleven souls, succumbed to the disease.

The scene of the second was less than a mile from that of the first outbreak, and although the occurrences were fewer, they were no less fatal.

The first case in the second outbreak occurred in the person of a man by name Tejgir, who helped to fire the infected shed where lay the dead of the disease in the first outbreak. After a certain interval he succumbed, having previously affected those about him; and a visitor from a distant village who, on his return to his home, took ill and died of the disease.

The father of the first affected is said to have died of *mahamari* seven years before; but there is no evidence to show any connection between the events, or that the recrudescence of the disease was due to any circumstance connected with the prevalence in the same locality in 1887.

The following summary shows the dates of the occurrences and connection between the outbreaks, and indicates the malignant character of the disease :—

Mahamari in patti Nakori, pargana Danpur, in 1893.

Place of occurrence.		Girl.	Women.	One person.	Two persons.	One person.	Two persons.	One person.	One person.	One person.
Mauza Surkali ...	Persons, Banias.									
	Date of attack,	8th July.	10th.							
	Date of death,	10th ,,	11th,	14th,	15th,	16th,	17th July.	1st,	2nd,	3rd August.

On the 17th August Tejgir helped to fire the shed in which the dead bodies lay.

Mauza Suni ...	Persons, Joggis.	Tejgir.	Monagir.	Gopalgir.	Female.
	Date of attack,	13th September.	17th,	22nd,	22nd.
	Date of death,	18th ,,	21st,	26th.	25th.

Punagir visited Tejgir when the latter was ill of the fever.

Mauza Maghera ...	Person Jogi.	Punagir.
	Date of attack,	13th.
	Date of death,	15th.

The persons who succumbed in the mauza Surkali comprised the members of two whole households; those in mauza Suni were of one family, and Punagir of mauza Maghera was a caste-brother of Tejgir. Punagir visited Tejgir on the 13th September, while the latter was ill of the fever, and returning to his home five miles away on the further side of the Pangra river, was seriously ill the next, and died the following day.

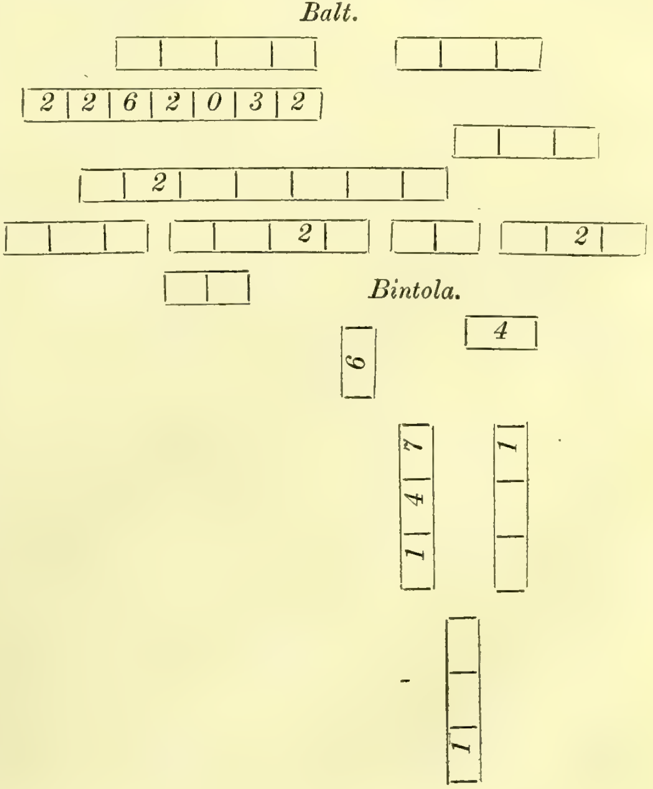
The inhabitants of Barkuri, separated by a spur of a hill from Surkali, vacated their village on the 22nd July, on account of a *great mortality among rats and mice*, and an outbreak of *mahamari* was thus in all probability averted.

21. In 1894, five persons died of the disease at Ira, patti Chaprakot, Garhwal, between the 5th and 8th January, and there were two more seizures, and between the 3rd and 4th May, a girl and a boy were reported to have died of the disease at Gadoli, patti Daijuli, pargana Chandpur, but Dr. Giles was of opinion that these deaths might have been due to famine fever.

22. A description of a Kumaon hamlet and the terrible effect among the people, and of the calamity which often befals many a household on the outbreak of the plague, may be best given in the words of one who personally observed the scenes and recorded his experiences of the extended outbreak in 1876-77 :—

"Balt and Bintola are two adjoining hamlets situated rather low down in a valley about four miles north-east of Almora.

"The houses are well built of stone, with solid roofs of thick hill slate. They are arranged in short terraces on the hillside, in accordance with the following ground plan, Bintola being lower placed than Balt. In the plan each square represents a house, and the figure the number of deaths which occurred in the family inhabiting the house :—



"The people of Balt and Bintola were friends. They had intermarried, and relatives of many families lived, part in Bintola and part in Balt; and the two villages might be considered one.

"*Mahamari* first appeared in Bintola early in November 1876 in the person of a child of the *padhan* or headman of the village. The child died on the 3rd day after it sickened, and while it was sick two other children of the same family were taken ill and also died. In the two houses which formed the homestead of the *padhan*, before the sickness commenced, there resided a family of fourteen persons in all. Of these fourteen persons, thirteen died at intervals during November and December, all with the same symptoms of disease, commencing with shivering, quickly followed by intense fever, ending in delirium, insensibility and death on the third or fourth day.

"In the terrace of three houses adjoining the *padhan's* home, three families resided, containing a total of fourteen persons. The women of these families helped to nurse the sick of the *padhan's* family, and during November and December twelve of these fourteen persons died of the same form of disease.

"At first the sick were nursed and died in the houses, afterwards the sick were nursed and died in temporary huts outside the village, and all the bodies were buried after death. In all, thirty-one cases of the disease occurred during November, December and January, and twenty-seven persons died. The four persons who recovered presented themselves to me on the 24th January for examination. All had the same appearance of extreme debility with emaciation, and one had a small bubo in the left axilla, which appeared on the sixth day of his illness seven days ago, and is now soon likely to suppurate, being hot and tender. Bubo was noticed both in the axilla and inguinal regions in some other of the later cases, but in none of those who died quickly at the first outset of the disease. And it was only after the buboes were seen that the people knew they were suffering from an outbreak of *gola*, the name given by the hill people to the disease. No appearance of bubo occurring in the first rapidly fatal cases, the people thought the disease was *sanjar*, a form of continued fever common amongst the hill people and frequently fatal, but believed to be less contagious, and therefore less dreaded than *gola*.

"From the time the people vacated the site to live in temporary huts or in caves on the hillside, only one death occurred, as will be hereafter described.

"In Balt the first case occurred in the person of a woman named Bani, who had gone to the *padhan's* house at Bintola to assist in nursing the sick children there. She resided and died in one house of a terrace of seven in the upper part of Balt; next her daughter died; then four persons died in the adjoining house; then her husband died, and the disease spread through the terrace; so that deaths occurred in every house excepting one, which was untenanted. In all, thirteen persons died in the terrace during December, and then, as at Bintola, the people of the villages vacated their houses so soon as *gola* or bubo was noticed as a symptom of the diseases in those who lived beyond the fifth day. Indeed, deaths from *gola* being reported, the civil authorities directed the people to vacate their houses, and they located themselves in huts of grass and branches on the hillside. All remained well, until a great fall of snow occurring on the 14th of January, the people returned to their homes; and during the succeeding five days, four more deaths occurred in the houses of the terrace, previously affected. The people seeing this return of sickness, fled at once to the hillside, leaving the sick, who died, unattended in the houses.

"The local conditions at Balt and Bintola were as follows: Both villages were uninhabited, the former inhabitants scattered in families miserably lodged in huts or caves far off; the village cattle roaming and feeding amidst the young wheat of the cultivated terraces around and below the villages. The torn remains of thirteen cows, calves or bullocks, and five goats, scattered in different places, witnessing to the truth of the local statement that, from dread of the disease, no one dare venture on to the site to house the cattle as night approached, and that consequently leopards and hyenas were devouring the flocks.

"The houses were double-storied, one room below and one above, *close, unventilated tenements. The lower room was used as a cow-house*, the upper room for family occupation. In the lower room, about five feet high, it had been customary to lodge from four to eight head of cattle or goats at night, and, indeed, in some instances, as many as the room had standing place for; the only opening being the small doorway or entrance, *tight, closed and barred at night.* These rooms were seen to be littered for about a foot in depth with decaying straw and much manure, moistened by the fluid excretion of cattle, and the entrance way on each side, and the stone platform facing the lower story, were piled with heaps of manure, which had been drawn out of the lower room as necessity required, and there left for eventual removal to the land in the ploughing season. The upper room was noticed to be roughly divided by wooden slabs into a front and back portion; the former used as the family sleeping place, *the latter as a granary.* The doorway, and in some instances a round hole in the front, and a small round hole for the exit of smoke through the roof of the house, all commonly closed at night, being the only openings. The floor was made of thin wood, with pretty numerous cracks, so that the warmth generated by the cattle below could reach to the sleeping people above, afterwards locally described as a beneficial arrangement.

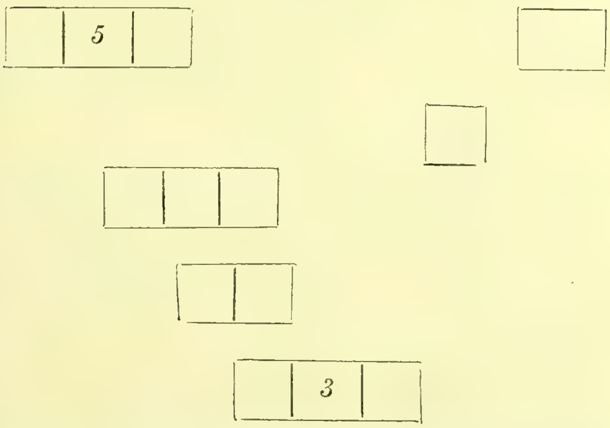
"Upon the stone platform facing the terrace, abovementioned, lay the broken remains of the four persons who had last died, their limbs and skulls torn and scattered by jackals.

"As regards the site generally, and the precincts of the village, nothing naturally insanitary could be seen. With the exception of a grove of pine trees at one place, the sharply sloping surface was clear of excessive vegetation everywhere. A mountain stream of bright water flowing between the village sites furnish an ample supply of good water for domestic purposes. Above the village sites all was clear, open rocky ground, around and below the sites almost all the surface had, by the patient industry of many years, been fashioned into narrow terraced fields, spreading down in green steps of young wheat and barley to the margin of the rocky stream flowing in the very bottom of the valley."

Alam is another village of about 12 houses, high placed in the precipitous mountainside above the Gori river. To reach it from the Gori valley side, the river, a boiling flood of snow water, has to be crossed by means of a cradle slide on a rope, the apparatus being temporarily provided for the use of the visitor.

The houses are placed on the mountainside in the following order :—

Alam.



Alam was inspected on the 12th of May 1877. In all, eight deaths in two families occurred here from *gola* disease, the following being the history of the outbreak :—

"The disease commenced in the *padhan's* family with the illness of the *padhan's* brother, who came home ill with fever from a shooting excursion on the 4th of March, and died on the 7th, swellings appearing in his groin before he died. In this family the wife of another brother and her child died during the period between the 7th and 23rd of March, and in both bubo cases appeared as a symptom.

"The man who first died lay sick, was visited several times by a man who had recently come from Ascot to settle with his family in three attached houses, highest placed of any in the village. This Ascot man was taken ill on the 11th and died on the 16th of March, a swelling appearing in his armpit before he died. He died in his house attended by his wife, who buried his body just outside the house door. Three days after he died, his wife was taken ill, and died after four days' illness ; and her body was left in the house unburied. The five remaining members of the family, four boys and one girl, fled to a neighbouring hut, where they lived together for a few days, the eldest, a boy of 14, acting as head of the family and providing food for the rest. This boy feeling himself ill, returned into the house alone and died, his body also remaining in the house. Four children remained, the eldest, a girl of nine, named Danuli, and her three brothers, aged respectively 7, 5 and 1½ years. Danuli worked for and fed them all for a few days, and during this period the boy of 7, wishing to take honey from a hive in the house, entered it with burning straw or wood to drive the bees away. Either from carelessness, or as the result of fright at seeing the dead bodies, he set the house on fire ; and all three tenements were burnt down. A few days after the house was burnt down, the boy of seven was taken ill and died in the hut ; and his death was followed by that of the boy of 1½, after an interval of some days. So that Danuli and one brother only were left.

"Before reaching the village on the 12th of May, I had been informed that possibly children might be found there abandoned. The village was found empty and desolate, and Danuli and her brother were found near the place of temporary abode outside the village, the former, a bright-eyed little girl dressed in an old petticoat, the latter, a little urchin wrapped in a piece of old blanket. These children had lost their parents by the 20th March, and from that date had beeen thrown on their own resources, except for a few days while the elder brother lived, for no person of the village would approach them.

"The girl Danuli recounted, in disjointed sentences, her experiences of the past eight weeks. Explained how her father, mother and big brother had died ; how all the people ran away out of sight ; how the house had been burnt ; how her brother of seven had died and his body been carried away by jackals in the night time ; how she had buried her little brother of 1½ taking the body in a basket and digging a trench for it with a pick ; and, lastly, how she had been left only with the remaining brother husking and cooking rice for both every day, leading her brother down to a stream to drink, and sleeping with her arms about him every night. Even now that so long a period had elapsed since the last person had died, no native person present would approach these children, sat hand in-hand, apart, as the girl told her pathetic tale of suffering and endurance.

"The two children were taken down the mountainside to a stream in which they were washed, their clothing was burnt, and they were re-clothed and provided with blankets. Afterwards they were passed in the cradle across the Gori, and given in charge of their grandfather, who was much moved at sight of the children and promised to care for them in his village on the mountain opposite Alam."

Such is the history of many a household during the occurrence of the plague, which exists to this day in British Garhwal and Kumaon.

23. The ever-recurring recrudescence of the plague in this portion of the Himalayas may be ascribed to the ingemination of a specific poison, and its spread by fomites and other means through neglect to destroy articles, etc., likely to convey and retain infection for long periods, and to the imperfect burial of the dead in

epidemic and at other times. The accidental uncovering of a grave, disturbance of soil, etc., or the unearthing of a long neglected or hidden household article may undoubtedly let free the specific poison just as the special communicable poison of scarlatina, small-pox, etc., may be wrapped up in a dirty rag or other article for years.

24. The cause of the disease, however, is still obscure. It has been ascribed by Dr. Watson to the eating of diseased grain, especially to the use of "*mandua*" (*Eleusine coracana*), and the fact that rats and mice which have access to grain stores die of the disease often prior to the outbreak among the people seems to have confirmed him in his belief, strengthened by the supposed fact that a quantity of diseased *mandua* sent from an infected village to be ground at a water-mill caused the death of all rats about the mill. Others have ascribed the disease to the use of *chua* (*Amaranthus frumentaceus*), and it is where this grain is chiefly used or forms the staple food of the people that the disease first breaks out. However, Doctors Francis and Pearson have pointed out that the villagers, on abandoning an infected village, take their supplies of grain with them, and that the pestilence is usually stayed, although the food-supply is the same as when the people occupied the infected locality.

Doctors Francis and Pearson fully investigated the point and satisfied themselves that Doctor Watson's supposition could not be supported by properly authenticated facts.

25. Light has lately been thrown on the etiology of the disease by investigations into the occurrence of the recent epidemic at Hong-Kong. The confirmation of the fact that *a special organism* exists in the blood and tissues of those affected by the disease seems to indicate that a special bacillus is the cause of the plague. The demonstration of its abundance in the inguinal glands of the affected and of the rapidly fatal effect of the inoculation of the micro-organism (an encapsuled diplococcus, difficult to stain by the usual reagents, but easy to cultivate on gelatine) on rats, mice and guinea-pigs would seem to point to a definite conclusion. *It only remains for us in the North-Western Provinces on the next appearance of the disease in the Himlayan hill tracts to confirm such conclusions, by demonstrating the presence or non-presence of the newly-discovered bacillus* in connection with the disease as it occurs among the people of British Garhwal and Kumaon.

26. *Mahamari* has been fostered by the uncleanly and filthy habits of the people of the hill tracts who house cattle, sheep, goats and other animals on the ground floors of their unventilated houses, and allow accumulations of sewage, refuse and litter in the immediate vicinity. They also defile and pollute the neighbourhood of the village in defiance of all sanitary law, and in their helplessness permit refuse and noxious weeds to fill the air with rank odours, adding to the foul emanations that penetrate every nook and corner of the overcrowded impure dwelling which forms a nursery of zymotic disease and is the birthplace of the pestilence.

27. The remedial and preventative measures, as embodied in the rules for the prevention of *mahamari*, comprise :—

(1) the housing of all cattle, goats, sheep, etc., in sheds at a distance of not less than 50 feet from the village, the sheds being located below the village if possible ;
(2) attention to the ventilation of houses and the prevention of overcrowding by the distribution of families in different rooms ;
(3) the prevention of nuisances in or near the village ;
(4) the clearances of accumulated filth, manure heaps and rank vegetation from within and around the dwelling-houses ;
(5) The preservation of the water-supply from pollution and contamination ;
(6) the evacuation of infected houses and of the village on the death of rats or mice in observable numbers or on the occurrence of the disease among the people ;
(7) the destruction by burning of bedding, clothing of the infected, and the proper cremation of the dead of the diseased ; and
(8) the destruction by fire of the house, together with any article likely to convey or retain infections in which a death from *mahamari* has occurred.

28. Continued immunity from *mahamari* in an epidemic form makes the rising generation, as Sir Henry Ramsay wrote in 1882, underestimate the danger "arising from the continued presence of this preventible disease."

It is still necessary to emphasize the need for increased watchfulness and for maintaining the strictest sanitary precautions to prevent the disease from assuming undue proportions in the hill tracts. Otherwise its incidence might even yet prove disastrously fatal among the overcrowded communities of *our hill sanitaria, within a few miles only of the locality of the ever-recurring pestilence.*

LEPROSY.

BY M. B. CARLETON, M.A., M.D.,
Subathu.

Varieties.—Tubercular and anæsthetic or mutilans.

Etiology.—At our present state of knowledge of the cause or causes of leprosy really nothing definitely can be said. Climatic causes have been mentioned ; syphilis malaria, want of salt, tainted fish, have their advocates, but so far without any proof—rather we think a decided disproof that any of the above causes are sufficient. While examining the causes of leprosy throughout the parts of the Himalayas, lying between the outer and inner ranges, we were struck with the very great prevalence of leprosy in this middle region. So also syphilis prevails most extensively throughout this middle belt of these mountains. Take for example the Simla division. By careful and extensive enquiries, it appears that there are not 5 per cent. of the population that have escaped syphilis, and this spread of syphilis has occurred within the past 30 years. So also in Kangra and parts of Kulu and the Native States of Mundi and Suket. In Kulu, it is claimed by the oldest inhabitants that during their younger days syphilis was unheard of, but now it is spreading rapidly, especially in certain localities, and this syphilis has been brought into the Kulu sub-division mainly from Kangra. In certain places I have traced it directly to a single person introducing the disease from Simla, and that within the past 15 or 20 years.

It is to be noted that from extensive observation among the people of the various Native States of the Simla division, and especially those towards the interior, syphilis* has very largely exhibited a peculiarity not found elsewhere in these mountains, an elephantiasis of the scrotum, penis, and nates, the penis attaining the length of a foot or more and correspondingly as thick, the clitoris, the labia in the same way becoming involved; the clitoris and adjacent parts enlarged to the size of a person's head, and weighing 6 or 8lbs., the labia on either side also attaining this size, and even larger, the two sides not equally so; of all I have seen and removed, the left side was the larger in size and weight.

This same elephantiasis growth is seen among the lepers coming from this region and nowhere else, as far as I have ascertained. It is commonly reported among the people that in this region, within a radius of 30 miles of Simla, not one per cent. of the people have escaped the taint of syphilis.

It is throughout this middle belt of the Himalayas that leprosy is so very prevalent. Simla division contains a larger proportion than any other part of India. Kangra, Kulu and the Native States of Mundi, Suket, Bilaspur, Sirmour, Chamba, and other Native States lying in this middle belt have also this large proportion. I am convinced that the habits of the people have been the cause for the very great and rapid spread of syphilis. But what is the cause of the great prevalence of leprosy? In the native mind, throughout this region, the cause is attributed to taking crude mercury administered by the *baids* and *hakims* for almost every ailment; while many say immediately after contracting syphilis leprosy made its appearance. Of the little more than 800 lepers I have examined, fully 90 per cent. acknowledged having had syphilis, while 10 per cent. only gave evidence of family taint of leprosy, near or remote.

No caste or religion appears to be more liable than any other; all equally susceptible in proportion to the population.

I am not prepared to say that there is any causative effect between syphilis and leprosy, and it may be only because of the low vitality caused by the syphilitic diathesis that the bacillus lepræ has an easier access and growth in the system.

It now remains to consider some of the phenomena connected with leprosy.

Leprosy is a constitutional disease springing from a specific poison, the bacillus lepræ, and consisting in a general dyscrasia, which manifests itself by certain characteristic derangements of sensation and of nutrition.

First.—*Deranged sensation.*—On the surface these occur in patches of varying extent and position, of either excessive heat, or, less frequently, of icy coldness, formication and tingling. This is invariably at the beginning of the disease and referred to the hands and feet—anæsthesia more or less complete.

In the deeper tissue there is pain in character greatly diversified, usually of a burning, clawing, or tingling kind, but invariably aggravated by motion or pressure.

Second.—Deranged nutrition.—Though for the most part connected with the disorder of sensation, yet begins at a later date. Its phenomena seem to be confined to the white fibrous tissue. These, it is true, include in some form or other a very large portion of the human frame; yet it will be seen from the following enumeration, and still more from the detailed account of the symptom to be given hereafter, that in these, and these alone, are to be found the lesions most characteristic of this disease.

During life the skin and its appendages, the subcutaneous tissue, the mucous membranes, the cartilage, and the synovial membranes of the joints exhibit most prominently those lesions which are a necessary result of mal-nutrition. Blebs, often as large as an inch or two in diameter, form on the hands and feet, forearms and legs, without any apparent cause, or more commonly the result of some slight knock or rubbing of the parts. Then also ulcers form on the integument and much sloughing takes place. All this may be the work of a few hours, or at the most two or three days, and gradually resolution takes place to begin again in some other parts.

There is ulceration and sloughing of cartilage and adjacent areolar tissue, ligaments, tendons, fasciæ, etc., leading at last to complete destruction and abolition of the parts affected, usually the phalanges of both hands and feet. Besides all this, there is in a certain class of cases a more or less abundant growth of tubercles. This is usually accompanied with anæsthesia, or in a very small proportion of cases is entirely free from that lesion, constituting the tubercular form of leprosy.

These tubercles appear to have been found in almost every part of the body. They are most conspicuous, however, in the alæ of the nose, the lobes of the ear, the eyebrows, and the lips. In many cases their first appearance would seem to be simultaneous with the occurrence of the phenomena of deranged sensations. Most frequently, however, they follow after a considerable interval. Finally, in a very large proportion of cases, they are from first to last absolutely no tubercles.

Death may occur early from destructive ulceration of the larynx. The natives particularly dread that form of leprosy in which the air passages are involved as being the most promptly fatal. In many cases death occurs from some heart lesion, as apparent from a marked tendency to syncope or from complications, the low state of vitality rendering the system incapable of resisting the onset of acute disease. In such cases the patients usually fall victims to pneumonia, bronchitis, enteritis, dysentery, malaria, etc. Probably the great majority of cases of leprosy end thus.

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* The nature of this disease is discussed in a paper by Surgeon-Major Cunningham, Civil Surgeon of Simla, in the Surgical section. —ED.

Symptoms and course.—The symptoms may be conveniently divided into two groups, the *subjective* and the *objective.* The former, including most of the mental and nervous phenomena of the desease, can be ascertained only by careful questioning and cross-questioning of the patient, since in their very nature they are cognizable by none but himself. The latter may be discovered by painstaking observation. The uncertainty which would seem to hang over the former is, after all, more apparent than real. The statement of patients as to their sensations are, poubtless, very often exaggerated or even untruthful. They must, therefore, be well sifted, while a fair average is struck from a large number of cases. Finally, the symptoms called objective must confirm and thus check those called subjective.

A. Subjective phenomena—1. *Of the mind.*—One of the earliest symptoms in an immense majority of cases is mental hebetude. There is a strong aversion to exertion, whether of the will or of the reasoning powers. Languor, listlessness, and more rarely melancholia, are characteristics of the disease. Above all, drowsiness may be regarded as pathognomonic ; very often the patient is irascible and hates society. In short, while no faculty of the mind seems to be lost, as in insanity, there is yet loss of *power* in all. Diminished sensation is followed by diminished perception. It is that impairment of memory which is so characteristic of the disease.

It is with reference to recent events that memory is most injured. Events that remind of the old days of health and vigour are well enough retained, while the most important engagement of yesterday is already forgotten. All the faculties of the mind come under this benumbing influence.

Such I believe to be a correct picture of the mental aspect of this disease. The assertion that it leads to idiocy is but partially true, so far as I have been able to gather ; the mind is weakened, but never deranged.

There is at the present time in the asylum at Subathu a leper idiot, with rounded stump for his hands and feet, and, so far as I can gather, he was mentally bright enough when first admitted, but gradually became what he is now. From this one example, we are not justified in drawing any conclusion as to the effect of the disease upon the mind ; other causes may have been at work in this case of which we are not aware.

One very interesting point to be noted is that these symptoms just described very frequently diminish in intensity, and at times quite disappear as the disease advances. Examples of this are at present in the asylum, apparently perfectly healthy persons, except for the deformity of hands and feet ; they tell the story, and, as far as we can observe, the disease has ceased to progress.

2. *Of the special senses*—These are certainly far less affected than has often been asserted, and it is remarkable that in some of the worst cases they are absolutely unimpaired. Many examples of this are seen in every asylum.

Not to mention many, I will offer one example, a woman of the Mahomedan religion. Her present appearance, so long as she conceals her hands and feet, affords no clue to the truth. There is no change in the face ; she talks cheerfully and sensibly, complaining of nothing partially. Her hands and feet tell the story ; they are but rounded stumps ; all the phalanges are gone ; some of the nails hang from the metatarsal bones ; the ulcerative process is arrested, all inflamed symptoms having disappeared ; white cicatrices remain to show the point of ulcers. The sensation of heat, of formication and tingling have disappeared. Her mind has been clear, and drowsiness no longer troubles. Of course anæsthesia still remains in the arms and legs, and so far as I have ascertained, there is no change in this respect, when in all other there is an improvement. The patient never was under any special treatment.

The *taste* is rarely much affected. All food, however, is said to have "an earthy taste." Hearing is often disordered, though cases of decided deafness are seldom, if ever, to be met with ; there is rather in most cases an excessive sensitiveness to loud sounds. This, however, may be due more to the peculiar state of the brain—weak yet at times very irritable.

The sense of smell seems to be impaired only when there is much thickening of the nasal cartilages as to impede inspiration ; or in other cases where there is serious thickening of the pituitary membrane.

Sight is most frequently affected in some stage or other of the disease. This disturbance is almost always amblyopia. There is dimness of vision, independent of any obvious structural cause, which does not amount to perfect amaurosis. Sometimes both eyes are equally affected. Simple asthenopia is very common ; also some complain of diplopia, especially at night. Very characteristic of leprosy is a chronic congested condition of the conjunctiva, which generally involves the cornea leading to entire loss of sight.

3. *Of general sensation.*—It is under this head that we meet with the phenomena most characteristic, almost diagnostic, of leprosy.

Sensation includes the sense of touch, of heat, cold, pain, etc., and is, as we all know, conveyed to the sensorium by the posterior columns of the spinal cord. In leprosy there seems to be an affection of those fibres of the posterior nerves, which run up longitudinally to the medulla. Peripherally those filaments are distributed throughout the whole body, but it is in the skin they are most numerous and most sensitive. The skin loses day by day its peculiar delicate sensibility, while the cartilages, periosteum, tendons, and fasciæ become the seats of a never ceasing pain. In the former the tendency is to anæsthesia ; in the latter to hyperæsthesia. In both there is from the beginning an intermixture of abnormal sensations, "burning, crawling, and

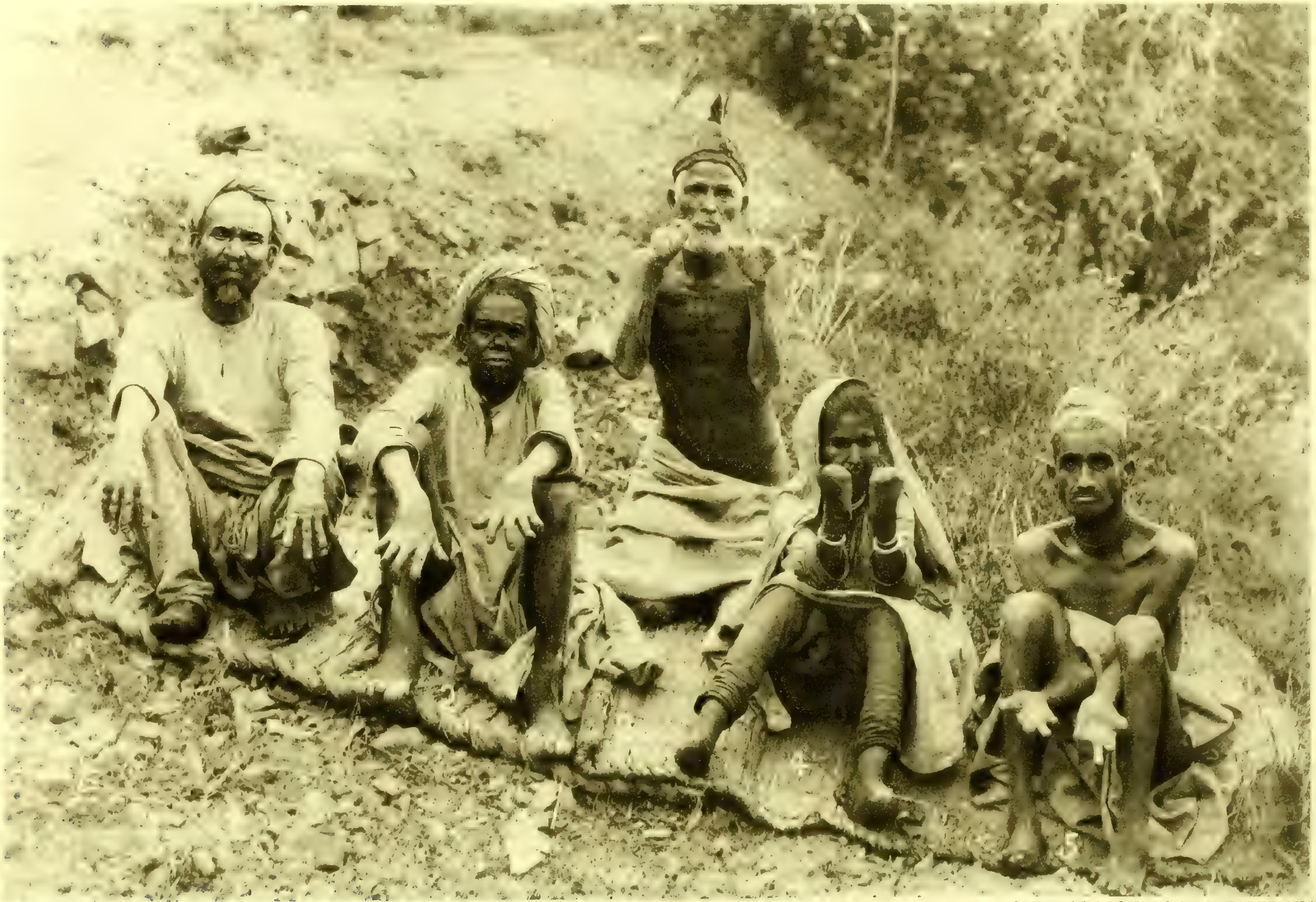

Photo-etching

Survey of India Offices. Calcutta. February 1895

PHOTOGRAPH SHOWING THE TWO TYPES OF LEPROSY.

TUBERCULAR LEPROSY.

No. 1. Age 36, Diseased 8 years. No. 2. Age 28, Diseased 10 years.

ANÆSTHETIC LEPROSY.

No. 3. Age 60, Diseased 28 years. No. 4. Age 40, Diseased 18 years.

No. 5. Age 50, Diseased 12 years.

tearing," and at last both end alike in insensibility, more or less perfect.

We find thus in leprosy the group of neurotic phenomena described as follows:—

A. *Superficial.*—The symptoms are much the same in all cases, varying in degree and position. They are, first, a sense either of burning or icy coldness, according to circumstances; second, formication, tingling; third, anæsthesia or numbness, more or less complete. The tactile sense is of course the first to suffer, rendering the patient liable to drop things he has picked up, nor can he grasp anything firmly. This is one of the earlier symptoms of the disease, and of itself is enough to arouse suspicion. I do not think it can be attributed to paralysis of the motor nerves, for none such exists. The tingling and formications are occasionally increased by pressure.

A leper can in no case walk long or far, and to walk barefoot-out-of doors is with most impossible, and with all painful, so intolerable does the prickling become.

This fact is one of importance in making a diagnosis when we consider how universally the people of India go barefoot. A similar effect is produced on the palms of the hands by firmly grasping a stick.

It is very curious to notice the way in which the abnormal sensation of heat and cold prevail; as a rule, it is of heat, an intolerable burning, that complaint is made. But let the thermometer fall to 50° F. and the patient begins to suffer acutely from cold. The objective temperature of the atmosphere, if much above or below a certain standard, is by the patient subjectively exaggerated and intensified in a way that to a healthy man is unintelligible. The influence of the direct rays of the sun, if at all hot, is invariably described by a leper as something overpowering. This feature of the disease is, I think, never absent even in its very earliest days. It derives its diagnostic value by the contrast presented with the ordinary habits of the people of the country, who are comparatively indifferent to the hottest midday sun.

The parts affected most frequently with this class of symptoms, *i. e.*, heat, tingling and numbness, are the extremities, the finger tips of all equally, or of one or two, beginning invariably in patches of small extent and capriciously placed. Before long they coalesce in greater or less degree, and gradually extend to the elbow and the knees, or even to the middle of the thighs and arms, and then almost invariably stop there. Very rarely anæsthtic patches are found on the face and on the trunk.

It should be remembered that even to the last, while limbs are absolutely insensible to pain, yet there remain often, here and there, small isolated patches of healthy sensitive skin. Again that while the anæsthesia is very frequently accompanied by discoloration or elevation or both of the skin, yet in very many cases there is absolutely nothing to distinguish the unhealthy patches.

B. *Deep-seated.*—Pain is the symptom that is most annoying and most permanent in the early stage of the disease. The pain is spontaneously present, or can be produced by pressure. Many never suffer pain of any sort as long as they are quiet. In the later stages of the disease only at times are there deep-seated shooting pains.

In many cases there is a constant pain independent of any exercise or pressure. This is most frequently in the legs. Occasionally the knees or the ankles are most severely affected; in other cases the wrists or forearms.

If careful enquiry be made, it will be found that the patient refers these pains either to the bones, the interior of the joints, or the tendinous extremities of the muscles. The pain is variably described; but on the whole it is said to feel as if a "living thing" were gnawing or clawing at the affected part. Thus a case under my observation referred the pain to gnawing of lice on the forehead, and was so much so that he rubbed the skin off in many places, trying to dislodge the lice which he firmly believed were eating him. In short, formication, which is the prevailing sensation in the skin, characterizes and accompanies the pain of the deeper parts. In some cases the pain is said to be of a burning kind, as if a red hot iron were thrust into the bone. The pains are remarkably constant, often prevailing night and day for many months. Occasionally these are most severe during the hottest weather, differing thus from rheumatism.

But while it is true very many cases of this disease may be met with, in which, so long as the patient remains at rest, he does not suffer at all, there is absolutely no case without what may be called "latent pains," pain that may be elicited at any moment by pressure or by exercise. A patient free from this symptom may, I think, be pronounced free from the disease itself. Pain may be elicited in about every part of the body. Thus it may be induced by pressure upon the pericranium; upon the periosteum whereever it is exposed, as in the long bones, the sternum, ribs, scapulæ, clavicles, etc.; upon the cartilages, as of the nose and ears, or as the larynx, the tracheal rings, the ensiform and the costal cartilages; upon the synovial membranes by passive motion of the joints; upon fasciæ; upon the tendons of the forearms, and wrists and of the leg and foot, especially noticeable in the tendo-achillis, the aponeuroses of the abdomen. In most cases it will be found that all, or nearly all, these parts are painful on pressure. Much depends on the stage of the disease. There is in most cases some degree of sensibility in the liver and præcordia, occasionally in the spleen.

The pain, which is on the whole most characteristic of the disease, is that which is felt between the knees and ankles after walking. This symptom never fails, and so great is the pain thus caused that the victims are forced at an early period to give up any work that requires much walking.

Tenderness on pressure of the spine.—This appears to be the most appropriate place to speak of what to my mind is one of the most important of the diagnostic marks of leprosy. I do not pretend here to account for the presence of this pain, but only mention it that others may take up the question, and perhaps determine the nature or cause of it. In all cases I have so far examined, none have been free from this spinal tenderness, and in all the intra-scapular space was found to be sensitive to pressure. In a large proportion, the region just below the sacro-vertebral junction was found to be similarly affected. In *no* case was this peculiar tenderness observed *above* the intra-scapular spot, the cervical and first dorsal vertebral being invariably free from it. In few of the worst cases, the tenderness extended over the entire space between the two points indicated above.

With respect to this subject, it should be remarked that the patient is never conscious of the existence of any disorder in the back. If questioned, he will declare without hesitation that he suffers no pain in the back, unless perhaps lumbago, when in the act of stooping. A firm and steady pressure should be exerted upon the spinous processes of the vertebræ from one extremity of the column to the other. In advanced cases once is enough. When the hand reaches the peculiarly sensitive spot between the shoulders, the patient often starts as if he had received an electric shock. Other cases are far less sensitive, and it will be necessary to go over the ground two or three times before the pain can be elicited. The patient becomes conscious of a dull pain in the intra-scapular space, which lingers and often increases after the operator's hand is withdrawn. At the same time the region above, although subject to the same pressure, remains insensible. There is no difficulty in recognizing the spinal tenderness so characteristic of this disease.

These two spots of spinal tenderness remind us of the cervical and lumbar enlargement of the cord. Why are these two spots so markedly sensitive ?

OBJECTIVE PHENOMENA.—1. *The pulse and other cardiac symptoms.*—Under the most favorable circumstances of rest and mental quiet, the pulse will in general be found slow, soft, and compressible, and not very much from the average. In all cases, however, it is extremely excitable, moving from 60 to 100 with the slightest provocation. Very slight exertion is sufficient to cause distressing dyspnœa and palpitations. This is especially striking in the people living among the hills, who spend their lives moving up and down the most precipitous mountain paths without fatigue. But when he becomes leprous, a hill-man is almost a prisoner in his own village from his inability to climb the hills. Much depends, of course, on the degree of heart affection. Physical exploration fails in any of these cases to reveal organic disease of the heart. Dilatation and hypertrophy there may be in some cases, for these are also very common among the non-leprous population of these mountains. But I am convinced that the disorder is mainly functional.

2. *The tongue, gums, uvula, etc.*—The tongue is rarely quite natural. It is almost always coated, and in most cases very decidedly furred and fissured. It is generally moist, soft, flabby, often covered with tubercles and indented by the teeth. The gums are apt to be spongy with a scorbutic look. Bleeding from the gums is a very characteristic symptom, more often than epistaxis, and so far I have not seen a case free from it. The pharynx and fauces are usually much paler than in health. There is a general relaxed condition of these parts, including the palatine arch and the uvula ; the latter is usually elongated, sometimes very much so, and with a marked lateral deviation.

Very frequently there are dark red patches, reticulation of highly injected vessels which stand out in relief upon the pale surface of the mucous membrane. In persons inclined to tubercles, the soft palate, tonsils and larynx are covered with irregular-shaped tubercles, gradually encroaching upon the air passages and causing terrible dyspnœa and difficulty in deglutition. This form of the disease is most rapidly fatal and most dreaded.

3. *Temperature* ranges, as a rule, a little higher than in health. It does not appear to diminish as the disease advances, some cases with mutilated extremities having temperature over 99°F.

4. *The urine* appears to be always normal, no albumen, reaction acid, specific gravity normal or little lower than the average, healthy colour, clear and free from sedimentary deposits.

5. *Organic lesions.*—The direct tendency of leprosy would seem to be merely towards malnutrition of the tissue involved.

It is on the surface of the body and in its extremities that we find the combination of circumstances most favorable to this malnutrition. It is here that the conditions of a vigorous circulation and abundant animal heat are most defective. Accordingly, it is precisely in the skin and the extremities that the most obvious lesions of this disease manifest themselves. The direct tendency of leprosy is *not* to destruction of the parts. It is rather to bringing about a low form of cell growth, a low vitality of the tissue, so that they are rendered *incapable of offering the usual healthful resistance to every-day causes of injury, whether chemical or mechanical.* In every case *external* senses appear to be essential to the development of any visible organic lesion. Such causes, for example, are heat, as of fire, or hot water, knocks, bruises, etc., and as they are agents that come daily and hourly into active play, it would be vain for the most careful man to hope to hold out long against their influence. These views are confirmed when we come to consider more in detail the lesions which attend the two forms of leprosy.

(*a*). The skin is always affected, and yet the affection of the skin is by no means so striking as is generally supposed. As its name implies, leprosy was once ranked among the more cutaneous eruptions ; and although such a classification was long ago abandoned, there is still a very general disposition to look to the skin for its most characteristic symptoms.

In an uncomplicated case of anæsthetic leprosy, two important points are to be noted in connection with the skin—patches of discoloration varying exceedingly in extent and position. These coincide with anæsthesia whenever they exist. The affection seems to be confined to the pigmentary layer, the colour being a little lighter than that of the surrounding parts. The difference of shade is always very trifling. *In true leprosy, whiteness I have never seen*, except as a result of cicatrization due to burns, caused by hot water or fire in cooking the food or bathing. It is very common for a leper sitting by the fire, as he shifts his position, to lay his foot or leg on a live coal, unconscious of what he has done, until he is informed of it by the smell of his own burning flesh. So, too, while cooking his food, he does not discover the burn on his hand until he sees the blister covering half his hand or up the forearm. Such burns, taking some time to heal, leave the patches so often seen on leper's hands. Sometimes in the disclored patches there is a slight elevation of the skin.

Far more important than any changes of colour is the universal change of texture of the skin, which invariably accompanies this disease.

It seems especially to lose the elasticity which belongs in an eminent degree to every healthy skin. There are two kinds of changes observed in different individuals, depending, may be, on the differences of temperament. In one class of cases the skin grows harsh, dry, horny, shiny, and drawn tightly over the parts below. It is in these cases that the malformation of the nails is most striking. They are ill developed, "stumpy," furrowed, etc. Possibly a taint of syphilis may have something to do with this condition.

In the other class, the skin is excessively relaxed, flabby, wrinkled, and very œdematous. In this class of cases I am inclined to think the tubercular form of the disease is more prominent than the anæsthetic. It is characteristic of the tubercular form of the disease that there is a tendency to lose the hair, eyebrows and eyelashes; not so in the anæsthetic form, except with the eye-lashes, when the meibomian glands and tarsal cartilages become involved in the advanced stages of the disease.

In the tubercular form of the disease the skin is affected by preference, the skin of the face producing that peculiar lion-like appearance, the ears, the back of the hands and forearms, and mainly the leg. This formation of tubercles appear to be the only changes to arise in the skin, independently of external causes. When once leprosy is fairly established, the slightest irritation, such as the friction of a shoe, or exposure to a hot sun, is enough to produce excoriations, fissures, ulcers, blisters, and blebs, according to the position and circumstances. As might be expected, the soles of the feet suffer greatly, especially the heels and ball of the foot, where in every case we find those insensible "punched out" ulcers, with undermined edges, which are so very characteristic of the disease.*

In other regions, where the skin is thinner and softer, blebs form, often without apparent cause, filled with a sanious serum. If the cuticle be preserved whole the liquid is reabsorbed otherwise very obstinate ulcers are apt to ensue. These, as they heal, leave ill-looking light colored cicatrices. Often these scars are perfectly white, and are, of course, very conspicuous. The characteristic white patches are invariably thus produced and ought to be carefully distinguished from the innocent leucoderma. Sometimes the cicatrices are of fleshy redness around the periphery with white centres.

(b) The mucous membranes always suffer. During life these are very evident, from our inspection of the mouth, fauces, the Schneiderian membrane, which has a tendency to suffocation, or the membrane is very generally thickened, rendering breathing through the nose impossible. The eyes are almost always red, especially as the disease advances. At first there are merely a few dirty looking blotches on the surface of the sclerotic; but soon the conjunctiva become infected and suffocation sets in. *Post-mortem* reveals congestion of the entire alimentary canal with tubercles and ulcers. The air passages suffer the same way.

I am inclined to think death is most frequently the direct result of ulcerative inflammation of the mucous membranes, either of the respiratory or of the digestive tracts. While under these conditions, a supervening diarrhœa, dysentery, or pneumonia quickly brings the end. The larynx is most liable to destructive ulcerations, as seen from the very large proportion of the lepers being affected in that part.

(c) In the *hands and feet* there is contraction more or less irregular, and capricious, of tendons and connective tissue, due very largely to burns. The same process seems to go on in the fibrous investing membranes of the muscles, causing compression and atrophy of the latter. Meanwhile, as the deformed process of nutrition goes on simultaneously in the bones and periosteum, fasciæ, ligaments and articular cartilages, a slight blow in either finger or a toe, such as may be received at any moment, sets up destructive inflammation. Precisely where this begins it is impossible to say; but probably in the bony structure, as in it vitality is at its lowest. Certain it is that caries invariably occurs. The superjacent periosteum, fasciæ and integument become more or less involved; the parts are greatly swollen; there is considerable fever; and if this occurs early in the disease, there is good deal of pain. Such an inflammation usually occurs suddenly within a few hours without warning and often without apparent cause. Finally, the abscess thus formed is opened by the process of ulceration or by lancing, and its contents slowly discharges. These consist of pus, mingled with disintegrated bone and other tissues. Large pieces of bone are rarely discharged, liquefaction having in most instances already occurred. When the abscess has emptied itself, it is often found that the skin has suffered least. It contracts upon the cavity and cicatrices, and retaining in many cases the nail, and so it is not at all rare to see the nail or nails projecting from the extremity of a metacarpal or metatarsal bone or bones. I have never known of a case where there was an absorption of the phalanges. A careful search will show in every case a cicatrix through which carious bone had been discharged.

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* These "punched out" deep ulcers are very often found on the nates, due to the custom of sitting on the ground when a slight injury causes the ulcer to form, often involving the greater part of the nates.

In many cases the process just described stops spontaneously before all the phalanges are lost. With the exception of one person in the Subathu Asylum, I have seen no case where the destructive process extended beyond the metacarpal or metatarsal bones. In this exception, first losing all the phalanges and the metatarsal bones, the destructive inflammation skipped the tarsal bones and attacked the lower ends of both tibia and fibula, which to the length of three inches liquefied and were discharged. The sinus healing leaves now only a two-inch attachment of integument, holding the tarsal bones to the remaining portion of the tibia and fibula. I can give no explanation of this. It may be because the greater vitality of the parts nearer the trunk offers an effectual barrier to the advance of the disease. The higher joints are sometimes threatened, but I have never known suppuration to occur.

The general health, the amount of suffering, etc.—There is a loss of animal vigour, though some think the reproductive organs are increased in power ; but this, if so, I am inclined to think will be found to be among those who are well fed and well kept in the asylum, and not due in any way to the disease itself.

There is a loss of vital elasticity, the mind grows dull, the body vegetates, the debility is great from the very first. there are regular night sweats. There is therefore a powerful effect upon the general health. Those functions, however, of organic life, which are supposed to be mainly under the influence of the sympathetic system, are not much affected. Appetite is usually excellent, the bowels regular, the urinary secretion normal. Were this not the case, indeed, it would scarcely be possible for the subjects of the malady to live so long.

It is quite common to see some of them living in comparative comfort for 20, 30, and even for 50 years after being affected with the disease.

It is certain that leprosy is far less to be dreaded, as regards the suffering entailed, than many other diseases. The liability to ulceration and caries is in a precisely inverse ratio to the sensibility of the part. The deep-seated pains are never found co-existing in any given spot with outward lesion. As the disease advances, these pains give way, at least in the extremities, to total analgesia. Whether it be in the skin or bones and joints of the phalanges, it is not until sensibility has entirely departed that the processes of ulceration and caries are fully established.

Hence, incredible as it often seems to the bystander, there is, with all these appalling lesions, absolutely no suffering ; the malaise of fever is the only complaint. Any one of these ulcers, whether deep or superficial, may be freely rubbed with strong caustics, without producing the slightest pain.

Of the constancy and symmetry of the phenomena very little need be said. In the earliest stages the subjective sensation of heat, tingling and pain, visit the patient only occasionally. And as the disease advances, the patient is seldom free from more or less of these symptoms, sometimes excessively severe. So, too, in the earlier stages, these symptoms appear to be more felt by a leper than could be by a person in health. Finally, all of these subjective symptoms diminish in intensity in the last stages, disappearing altogether in many cases. Abnormal sensations have now given way to perfect insensibility.

The question as to whether the phenomena of leprosy is symmetrical, if an important one, as it goes far to decide whether they are due to local lesions or to a general diathesis. Viewing the subject generally, there can be no doubt that the phenomena are essentially symmetrical. At the outset, one side often shows the disease earlier than the other ; but this never lasts long without the appearance of similar symptoms on the opposite side. This then lasts during the entire course of the disease.

As to the effect or frequency of the disease as regards sex, nothing new can be said. Sufficient to say that there are more of the male sex affected than the female. Why we cannot say, unless we say that men, going as they do far from their homes, become more liable to external causes, contagion or whatever you may wish to call it.

Of about 500 lepers admitted to the asylum at Subathu since 1870, only 71 were women.

The *complications* of leprosy are important, chiefly as they tend to mask disease and modify the treatment ; but, as we do not now intend to discuss the latter subject, simply because there is nothing really new or important that may be said, we see no reason for saying anything on the subject of complications, except briefly to enumerate anæmia, scurvy, cutaneous affections, rheumatism ; lastly, the most important, syphilis, as having more or less effect on the progress or manifestations of leprosy.

Treatment.—When we come to the subject of treatment we are brought to a stand ; for so far, of all the medicines and lines of treatment advocated, none have stood the test of a radical cure.

I have tried the more recent specifics, as ichthyol, resorsin of the Unna method, and during this year to a limited extent europhen, for which much is claimed, but in my hands has not met expectations.

In closing, allow me to go over briefly the more important diagnostic signs of leprosy.

1. Pain on pressure in the intra-scapular space, more rarely similar sensitiveness lower down the spinal column.
2. In general a feeling of excessive warmth, *i.e.*, apart from the patches in which a sensation of burning occurs. The patient is, for the most part, uncomfortably warm or the other extreme, a feeling of excessive coldness exists.
3. Lethargy of mind and body. Especially is the tendency to sleep night and day noticeable. The animal vigour is far from energetic.
4. Amblyopia and asthenopia, more rarely double vision, are frequent symptoms.
5. Excessive debility.
6. Tendency to copious perspiration, provoked by the slightest exertion, and to night sweats.
7. Presence of frequent dry tickling cough.

8. Dyspnœa and palpitation of the heart, the sounds meanwhile being normal or nearly so.

9. Intolerance of the direct rays of the sun.

10. The skin being either flabby, wrinkled, and œdematous or harsh, shining, horny, and drawn. The soles of the feet usually hard and fissured.

11. The nails, in proportion as the case is purely one of the anæsthetic type, are stumpy, ill-nourished, and short. In cases complicated with tubercles the nails suffer very little. In the latter case it is the hair that is affected. This drops out first at the outer angles of the eyebrows.

12. The blebs, patches, ulcers, cicatrices of leprosy are all peculiar and diagnostic. The cicatrices are either white or a light brown.

13. There is something very characteristic in the way in which phalanges slough *out* instead of sloughing *off*, leaving a nail at the end of a shortened finger or toe.

14. The contraction of the tendons and fasciæ, and even of the periosteum in both hands and feet, is highly characteristic of anæsthetic leprosy. In the tubercular form, it is certainly not so often seen.

15. Spongy gums, easily and frequently excited to bleeding ; epistaxis also very common.

SUBATHU ASYLUM.

Total of castes or religion, 1875—1894.

Caste or Creed.	Sex.		Total.
	Males.	Females.	
Koli	56	8	64
Chamar	37	7	44
Caste unknown	38	10	48
Kanait	101	13	114
Brahmin	53	8	61
Julaha	21	1	22
Domna	27	10	37
Lohar	11	5	16
Rajput	32	2	34
Jat	2	...	2
Kumhar	4	...	4
Jhinwar	5	1	6
Ramgar	2	1	3
Nai	1	...	1
Chhimba	6	...	6
Kahar	1	1	2
Mahomedan	10	2	12
Chanal	8	1	9
Gujar	2	...	2
Garauja	1	...	1
Mali	1	...	1
Sweeper	3	1	4
Goorkha	2	...	2
Faqir	5	...	5
Christian	2	...	2
	430	71	501

LEPROSY.

BY C. L. KAJI.,

Kattiawar.

I have prepared statistics of the cases under my observation, and, for the sake of convenience, they can be grouped as under :—

I. The varieties of the disease ;

II. Its connection with heredity and syphilis ;

III. The ages at which the disease commonly makes its appearance ; and

IV. Lastly, the frequency with which the different parts of the body are likely to be affected.

I shall begin with the forms of the disease. The most common are the anæsthetic and the tubercular. In certain cases both varieties are found to be present in the same individual.

The anæsthetic variety generally begins in the form of white or dark-red patches. These are sometimes hyperæsthetic in the beginning, but mostly they are anæsthetic. Later on the patches in many cases disappear, leaving the parts more or less anæsthetic It is not uncommon for the disease to commence by the appearance of blisters, most commonly on the fingers and toes. The parts swell and thicken, burning is experienced in the parts, and all of a sudden blisters make their appearance. These burst, discharging a watery fluid, the burning ceases, ulcers form, and these then heal up, leaving the parts anæsthetic.

The tubercular variety begins by the appearance of tubercles under the skin on various parts of the body, which may or may not become anæsthetic. The skin covering the tubercles thickens and the conglomeration of the tubercles gives a nodulated appearance to the parts affected. Ulceration, though not so common as in the anæsthetic form, is not infrequent in this variety.

The above described features lead to the supposition that the morbific principle, contaminating the mass of blood in leprosy, affects by election, the terminal nervous filaments supplying the skin, as shown by the burning sensation experienced before the appearance of blisters.

Another characteristic of the disease is the mutilation of fingers and toes. The blood is so much vitiated that the ulceration left by a blister, instead of healing up, attacks and destroys the deep tissues and reaches the bone, which, being thus deprived of the support of the surrounding tissues, drops off, and the remaining stump may heal up, or the destruction may proceed further and the fingers and toes fall off bit by bit.

In some cases the feet are shortened with the toes entire. This happens as a result of ulceration of the sole of the foot at the distal extremity of the metatarsal bones. The ulceration attacking the deep tissues loosen the metatarsal bones, which fall off. In the subsequent healing process, the parts deprived of the bony frame work contract, and thus, as it were, draw in the toes towards the tarsal bones and cause shortening of the foot.

The statistics of 127 cases given below will to some extent give an idea of the relative frequency of the different varieties of the disease.

I have divided the cases into four classes, *viz.*, anæsthetic, tubercular, mixed, and hyperæsthetic, and each class is again sub-divided into simple and mutilated.

Out of 127 cases there were—

Anæsthetic	88, of which	46 were simple. 42 ,, mutilated.
Tubercular	6, all simple.	
Mixed	32, of which	24 were simple. 8 ,, mutilated.
Hyperæsthetic	1. Simple.	

From the above it will be evident that the anæsthetic form is the most common; next comes the mixed; then the tubercular, and last the hyperæsthetic. The solitary case of the last form was a girl aged 13 with distinct family history (her father and two uncles had the disease) and the duration was only one year. It may develope later on into anæsthetic or any other form. It may be that the purely hyperæsthetic form is so rarely met with, because, as a rule, cases of leprosy do not come under observation sufficiently early.

The mutilation is most frequent in the anæsthetic form, of which about 47·7 per cent. were mutilated. In the mixed variety 33·3 per cent. of the total mixed cases were mutilated, while in the purely tubercular form there was not a single case of mutilation. This goes to shew that mutilation is more commonly associated with the anæsthetic form.

II. Next comes the question of the influence of heredity and syphilis.

It is still a vexed question whether any, and if so what, influence is exerted by heredity and syphilis on the propagation of this disease. In such an uncertain state of things, statistics bearing upon the question will not be out of place.

Out of 128 cases there was—

Family history of	Leprosy in	68
,, ,,	Syphilis in	21
,, ,,	neither in	48

In nine cases there was history of both heredity and syphilis.

In connection with the influence of heredity the report of the late Leprosy Commission states that only direct family taint from parent to child should be counted in favor of heredity, and thereby excludes the collaterals in ascertaining the influence of heredity. In taking such a limited view, it will have to be admitted that the leprosy virus retains its activity for one generation only, and after that it is either existent, but not potent enough to exert any influence, or is non-existent, and its total extinction has taken place. But in diseases liable to be transmitted by heredity, such as syphilis, cancer, phthisis, etc., it sometimes happens that the desease fails to appear in one generation and appears in the next. Further, the same virus acts with different degrees of intensity in different individuals, and even in the same individual under different conditions. Thus it seems that the virus may be present, but something more is necessary for its manifestation in a particular individual. This something more is perhaps a suitable constitution. There is no reason why what applies to other constitutional diseases may not with equal force apply to leprosy. The virus transmitted by heredity may manifest itself only when it meets with a constitution not having sufficient resisting power to withstand the influence of the virus. This may also account for some one generation remaining free.

In the 68 cases in which family history was present, the relatives alone or conjointly with other relatives found to have been affected were as under —

In 27 cases—Father or his parents.
,, 6 ,, Mother or her parents.
,, 13 ,, Uncles or their direct relatives.
,, 11 ,, Brothers or sisters.

In the remaining 11 cases the affection was observed in relations more or less distant.

In the 60 cases in which no family history was observed, allowance will have to be made for the imperfect knowledge of the patients, who again generally belong to a class not very particular in its statements.

The question is whether syphilis is likely to exert any influence on the propagation of leprosy.

To say that syphilis has a direct influence on the propagation of leprosy would not be borne out by experience, as comparatively a very small number, indeed, of the persons who had contracted syphilis in some period of their life seems subsequently to present symptoms of leprosy. On the other hand, to say that syphilis does not exert even an indirect influence on a constitutional disease like leprosy would certainly render it difficult to explain the influence it is said to exert in most of the constitutional diseases.

The frequency with which syphilis is found to have been connected or associated with most of the constitutional diseases, its power to exert, when so connected, a modifying influence on the course, progress or propagation of almost all diseases, and its tendency to affect all the tissues of the human body in more ways than one, clearly show that the syphilitic virus is a very potent morbific matter. The close and distinct connection which has been observed in some cases between syphilis and the various other constitutional diseases, such as scrofula, tuberculosis, carcinoma, coupled with the fact that nothing definite is as yet known regarding the specific virus, if there be any, of these various diseases, the frequency with which the children of syphilitic parents are born with scrofulous diathesis, and the fact that in the category of maladies due to scrofula there is a large number which again may be found in the diverse consequences of syphilis—all these are likely to give rise to the question whether the morbific principles concerned in generating the several constitutional diseases are not in some way related with one another.

A specific morbific principle is ascribed to each constitutional disease. Now, if a constitutional disease, syphilis for instance, instead of being due originally to a specific virus, of which no one has still been able to discover the nature, much less the origin, be supposed to have begun in some disturbance of the vital energy, brought about by insanitary conditions, habits, etc., and manifesting itself in a group of symptoms and a set of organic changes in the tissues and secretions of the system, the persistence of such a disturbance will sooner or later impress its stamp on the structure and functions of the different tissues on which it exerts its influence. The disease at this stage acquires its specific character, and will be liable to be transmitted by heredity to the offspring who derives the germ of its body from the parents. If now the germ of the disease remains latent owing to the absence of conditions favourable for its manifestation, in course of time it will wear off. The length of time required to bring about this result will, of course, depend on the intensity of the impression. If the constitution is exposed to fresh conditions of a different nature, while the impression is not completely effaced, the disease may appear in a new form, though still showing some of its original characteristics. This will explain the hereditary tendency of such diseases as syphilis, cancer, phthisis, leprosy, etc., as also the points of resemblance they show in their mode of affecting the various tissues while retaining their own characteristics more or less. Syphilis is more frequently spoken of as exerting influence on other diseases, perhaps because its sphere of action is the most extensive and its impression on the system the strongest.

III. The age at which leprosy more commonly makes its appearance.

The following is the result of observation in 134 cases :—

In ages up to 10	...	... 13	*i.e.* 9·7	per cent.
From 11—20	...	... 37	„ 27·6	„
„ 21—30	...	... 57	„ 42·5	„
„ 31—40	...	... 11	„ 8·2	„
„ 41—50	...	... 13	„ 9·7	„
„ 51—60	...	... 2	„ 1·5	„
Above 60	...	... 1	·7	„

The generality of patients resorting to the asylums belongs to a class which is not particular about age, and for this very reason they cannot, as a rule, fix the exact time when the disease first began.

So far as the above statistics go, the greatest number is affected between the ages of 20 and 30 ; next in frequency is the period between 10 and 20. The frequency is nearly equal in ages under 10 and between 30 and 50. It is rare about 50 and during infancy. Thus the liability to be affected increases with age up to 30, when it begins to decline as age advances.

The disease is most frequent between the ages of 20 and 30. It is a period of greatest activity of the system. Thus the frequency of the occurrence of the disease varies directly as the activity of the system. When the system is in a state of activity, the various tissues and organs are in a state of stimulation, and thus more susceptible to the influence of morbific principles. The same thing occurs in phthisis, another constitutional disease, as will be seen from Dr. William's table. In 1,000 cases there were—

In ages up to 10	...	... 13	*i.e.* 1·3	per cent.
From 11—20	...	... 182	„ 18·2	„
„ 21—30	...	... 418	„ 41·8	„
„ 31—40	...	... 249	„ 24·9	„
„ 41—50	...	... 94	„ 9·4	„
„ 51—60	...	... 30	„ 3·0	„
Above 60	...	... 14	„ 1·4	„

IV. As regards the frequency with which the different parts of the body are liable to be affected by leprosy, I cannot do better than give here the statistics, prepared from a limited number of cases that come under my observation.

Dividing the body into five parts, *viz.*, head, face, trunk, upper and lower extremities, they were affected in the following order of frequency in the 127 cases observed :—

Lower extremity ...	... 122
Upper „	... 120
Face „	... 68
Trunk „	... 63
Head „	... 20

In the above cases, there were none in which the head or trunk alone was affected. The head was affected in those cases only in which the whole body was more or less affected. In one case only, the trunk was free and the head affected with the face and the extremities.

It will be seen from the above table that the disease affects with greater frequency the parts more removed from the centre of circulation. Taking the different portions of the extremities and the face the same thing happens. The disease more commonly begins in the fingers and toes in the extremities, and the nose and the ears on the face, and then spreads to the other parts. This once more explains that the specific virus manifests itself when and where it meets with insufficient resisting power. The parts most removed from the centre of circulation have necessarily a minimum share of vitality, and therefore the least resisting power, which renders them less likely to be able to withstand the influence of the specific virus when it finds the system in a condition favorable for its manifestation.

In conclusion, I would only touch a point or two in connection with the causes of leprosy. In certain cases that came under my observation, the disease first made its appearance after the patient was bitten by a mouse, and started from the point bitten.

Leprosy is attributed to a bacillus discovered in the blood of lepers.

As for the treatment of leprosy, I am as yet not prepared to say anything definite in regard to it. But I hope, on some future occasion, to be able to lay before the profession some remarks on the point.

LEPROSY WITH SPECIAL REFERENCE TO KASHMIR.

BY A. MITRA,
Kashmir.

THE valley of Kashmir has a population of 949,041, of which 883,252 are Mahomedans and 65,789 Hindoos. The inhabitants of the valley proper are distinct from the people living on the slopes of the mountains around. Rice forms the staple food of Kashmiris, which they eat twice daily, with boiled vegetables. Meat is also eaten daily, but only by the better classes. Fish, fresh or dried, is freely used. The majority of the people are agriculturists. The boatmen form a large bulk in the population, and they eat more fish than others. The boatmen on the Woolar Lake live principally on fish, which they cook in the form of pulp, and eat with salt. Syphilitic diseases are the scourge of Kashmir. The rate of infant mortality is very high on account of syphilitic diseases. The habits of life of the people are very unclean, and there is an utter disregard of public and private hygiene. Among the people I have described, leprosy is a rare disease. A census of lepers was taken in 1890. It was taken unassisted by medical officers, and therefore, no doubt, included many cases of diseases other than leprosy, and excluded many cases of true leprosy in the incipient stage. It also omitted to record the nationality. Many foreigners might have been entered in that list. It showed the total number of lepers to have been 202 : male 168, female 34. Hindoos 4 and Mahomedans 198. I have not met with more than 30 real Kashmiri lepers. What may be the cause of this comparative immunity of Kashmiris from leprosy?

It is a strange fact that Kashmiris are almost surrounded by neighbours among whom leprosy must have been prevalent for a long time. In spite of this, the Kashmiris, living in the valley, have been free from the disease. The slopes of the hills between the flat ground and the limits of snow on the Pir Punjal ranges of the Himalayas are a mixture of cultivating and grazing grounds and forest of cedar and pine. These slopes are inhabited by a people called Goojurs, or cowherds, who keep buffaloes and cows. In winter, the Goojurs live at the foot of the hills ; and in summer, in temporary huts on the mountains. Their food is Indian-corn or wheat, and they use milk and milk products abundantly. They live in ill-ventilated houses, often over-crowded with men and cattle. They are not well clothed. They are not beef eaters, but occasionally indulge in buffalo meat. Among these Goojurs, leprosy is a common disease. Lepers are not allowed to mix freely among others in the Goojur country, and a leper has to take his food apart, even from his nearest relatives. The lepers, therefore, usually come to Kashmir, or go to adjoining districts in the Punjab, for means of livelihood. The Punjab is very hot in summer, and Punjabi lepers find that, during the hot season, eruptions frequently break into ulcers, which heal in the temperate climate of Kashmir. So annually a large number of Punjabi lepers flock into Kashmir during summer and live on the charity of the Kashmiris.

Heredity.—Heredity is, no doubt, an important factor in the causation of leprosy. Such is the opinion I have formed after careful enquiry among Goojur lepers. I have seen a family with three generations of lepers. Of course, in many cases, heredity could not easily be traced, but in all such cases unsatisfactory answers were elicited. There are, no doubt, cases of acquisition, but among the Goojur inheritance plays a more important part than acquisition.

Is leprosy contagious? I saw one instance of a wife acquiring leprosy from an affected husband. Five years after marriage, the husband showed symptoms of leprosy ; after another five years, the wife became affected. When I saw the couple they had no children. I have seen in a family, the grandmother, an old woman, suffering from a very bad type of ulcerative leprosy, attended with fetid discharge and sloughing. The daughters and grand-daughters nursed her without the slightest thought of themselves. The old woman died five years ago. None in the family are affected. From my own experience I can cite no instance in which the disease was transmitted from a leper to any members of his family with whom he lived together and mixed closely in social life, except the one in which the wife was affected. Though leprosy is not common among the Kashmiris, still Kashmir is resorted to by a large number of lepers for its climate and means of livelihood. These lepers freely mix with the people, sit, eat, and pray with them (lepers are usually found at the doors of Moslem prayer-houses), and no precaution against contagion is thought of, still the disease does not spread among the Kashmiris. In India and in the northern hilly countries, we find lepers freely mixing with their relatives, walking about in public streets ; leprous husbands having progeny from their unaffected wives ; in short, the public is exposed to the disease in every conceivable way. Does it extend in the proportion it ought, if contagion by contact be admitted? How then is leprosy transmitted? Accepting the bacillar theory of the disease, one could easily imagine that it may be passed from one individual to another by various means, by which any other disease is depending on germs, such as tuberculosis may be transmitted.

Of course, contagion by inoculation is possible, and often takes place in various ways. All the different ways by which syphilis can be passed from one individual to another extra-genitally hold good for leprosy. In India people usually have their feet and skin bare, and therefore there is every likelihood of inoculation. However much we may differ in this and similar points, I have no hesitation in saying that free leper asylums for the care of lepers all over the country is an absolute necessity for preventing the spread of the disease. Such asylums should be made attractive by clean hygienic surroundings, substantial and wholesome diet, recreation and diversions, and medical treatment and comforts. Then not only the poor, but many others of the middle class, will voluntarily flock into them. In such asylums, not only caste, but distinction of social position of the inmates should be observed. Those who are willing, or can afford to pay, will be paying inmates. Every district board which maintains a dispensary should maintain a leper asylum also. By this means segregation will be practically done without raising any clamour or opposition. I believe that to the improvement of general sanitation and habits of life of the people, we are to look for extermination of the disease more than to any measures of compulsory isolation.

Hutchinson's fish theory.—The Goojurs do not get any fish. I have for some time always asked lepers if they are fish-eaters, and, in the majority of instances, the reply was in the negative. The theory is untenable in India, where we do not find the disease more prevalent among fish-eating people than among abstainers of such food, as *Vaisnabs.* High class Hindoo widows are strictly prohibited from taking fish, but I have seen several cases of leprosy among them. The Kashmiris, among whom leprosy is rare, are fish-eating, fresh, dried and salted. Bnt the fact that leprosy is common among Goojurs completely disproves the fish theory.

Treatment.—In the treatment of leprosy, I have given trial to chalmugra oil, gurjon oil, neem (*Azadirachta Indica*), both internally and locally. I have also tried arsenic phosphate, of soda, madar (*Calotropis gigantea*). In the ulcerative stage, local application of gurjon oil or neem oil prove of some value in healing and checking fetor. Creolin or izal does the same. My experience is that none of the above remedies possess any power in arresting the disease.

In the anæsthetic variety I have practised nerve stretching in over a hundred cases. I am of opinion that in the early stage nerve stretching produces some satisfactory result. The tracts supplied by the nerve or nerves stretched, regain sensation partly, trophic ulcers heal rapidly, and the general health of the patient improves ; but these results are not lasting. A patient whose nerves were stretched, and who left the hospital with his condition improved, encouraged by previous result, comes back after a year with the same conditions as before, and probably with lesions spread differently over other parts, such as face. This treatment can, therefore, be safely called a palliative treatment, applicable, in certain classes of the disease, in its incipient stage. I have never seen a leper cured, but under strict medical care, he can be made comparatively free from his troubles, and his sufferings can be alleviated.

THE INFLUENCE OF SEASON ON GOITRE.

BY G. HUTCHESON, M.D.,
Brigade Surgeon Lt.-Col., I. M. S.

1. Goitre is very widely distributed in Northern India, and prevails, and is specially localised, in certain well-defined areas from the Brahmaputra to the Indus, and in particular valleys from one end to the other of the Himalayas.

The disease is also prevalent in Nepal as in other Himalayan valleys. In and around the valley of Khatmandu, 4,500 feet above sea level, the mean of the valley being 4,784, as many as thirty to forty per cent. of the people may be affected, it is stated, and it is by no means uncommon to find animals, such as goats, sheep and dogs, with the complaint. The cold weather in Nepal sets in about the middle of October and lasts till the end of February, snow sometimes falls in the valley, ice occasionally covering the tanks and pools ; and hoar frost is by no means an unusual occurrence.

2. The disease exists among people who inhabit the sand and mud banks of Eastern Bengal and Assam, the laterite soil of the Dacca and Mymensingh districts, among those who have their abode on clay soil, on the calcareous soil of the Trans-Gogra districts of the North-Western Provinces, on the alluvian and detritus of the Tarai as on different classes of soil in the Punjab.

3. Much has been written with reference to the association of goitre with calcio-magnesic or dolomitic water supplies, and many of the waters of the hill tracts and of the Bhabar and Tarai districts are of dolomitic orgin. The disease prevails, however, where the potable water is not of such a character. The disease occurs in the Tarai districts as far as the Brahmaputra, and among people, as in the Ballia districts, of the North-Western Provinces far removed from solid magnesian limestone formations or water-supply derived therefrom. Further the disease does not in many cases follow the prolonged use of distinctly dolomitic water; and the Mussoorie and Naini Tal waters, which are of a marked dolomitic character, do not produce goitre as would be naturally inferred if that particular theory of the origin of the disease had any foundation in fact.

4. In 1893, there was, as occurs in exceptional seasons, a very marked and exceptional prevalence of goitre among all sections of the community at Haldwani, Kaladhungi and Ramnagar, towns of the submontane tract, otherwise named the Bhabar and Tarai tracts, of the North-Western Provinces. The disease occurred both among those who used a piped water, and equally among those who used canal water and other sources of supply. This exceptional prevalence of the disease extended east and west along the whole of the submontane area from Dehra Dun to Gonda and Gorakhpur, and was noted also in the Himalayan hill tracts of the province. The percentage of increase in cases treated during the first five months of the year to the total cases treated in the previous year varied from 77 to 120. At Haldwani the total number of cases of goitre treated in 1893 was 671, as compared with 193 in the previous year; at Kaladhungi 244 against 71; and at Ramnagar 409 against 91. There was certainly *no connection between the water-supplies of the different distant localities in which the disease was exceptionally prevalent at the same time; and the composition of the different water varied from the almost absolute pure to those which were of a marked*

calcio-magnesic character. At Ramnagar, where the water-supply is of exceptional purity and free from calcic or magnesic salts in any appreciable quantity, the increase in the percentage of cases of goitre treated in the first five months of 1893, as compared with the total treated, in 1892, was greater than in other localities with a more doubtful water-supply. In fact the *disease occurred among a people with a general water-supply, as free from organic or mineral impurity as the water of Loch Katrine*, one of the standard potable waters of the world. The exceptional purity of the supply is indicated as follows:—

Locality.	Source of water-supply.	Appearance.	Grains per gallon.		Parts per million.		Degree of hardness.		
			Total solids.	Chlorine.	Free ammonia.	Albuminoid ammonia.	Permanent.	Temporary.	Total.
Ramnagar ...	Spring.	Clear	4	3	·00	·016	2·5	·5	3

The association of goitre with the use of such high-class water is more than doubtful. In other localities, however, the character and quality of the water was not so good as indicated in the following statement:—

Locality.	Source of water-supply.	Appearance.	Grains per gallon.		Parts per million.		Degrees of hardness.		
			Total solids.	Chlorine.	Free ammonia.	Albuminoid ammonia.	Permanent.	Temporary.	Total.
Haldwani ...	Stream...	Clear	19	·25	·02	·02	6	8	14
„ ...	Spring...	„	13	·2	·008	·04	4·5	6·5	11

5. Dr. F. N. Macnamara, formerly professor of chemistry in the Calcutta Medical College, after an elaborate and systematic chemical examination of the potable waters of Bengal, and careful consideration of facts regarding the localization of the disease, arrived at the conclusion that goitre depends on a malarial influence which developes locally and may prevail on any soil coincidently with the use of any water, excepting that the conditions of soil, water, air and climate must be such as generate malarial disease. Goitre prevails along the Brahmaputra, in Assam and Chenab rivers, in the Punjab, in certain localities on the rivers bank; and is absent in other localities not far removed where the people use the same source of water-supply for all purposes. Dr. Macnamara, after summing up the results of his very extensive series of analyses of the potable water of the Bengal Presidency, concludes by stating that an examination of all the data "is quite sufficient to disprove the view that an excessive quantity of lime and magnesia in drinking water is the efficient cause of the disease."

6. The extreme prevalence of the disease in certain seasons is due to obscure climatic, meteorological and other conditions of particular localities, of which the water-supply is a minor factor. Comparing the data of years of maximum with years of minimum prevalence in districts where the disease is endemic, the increase over the minimum in cases treated at Government dispensaries reaches *over 400 per cent. in some districts.* In the Gorakhpur district the annual number of cases treated has ranged during the past twelve years from 8,169 in 1891 to 20,188 in 1884 ; in the Gonda district from 2,535 in 1891 to 8,174 in 1883; and in the Basti district from 1,416 in 1891 to 6,056 in 1884. The year 1886 was one of very exceptional prevalence of the disease in the submontane tracts, and the number treated reached the maximum recorded during twelve years in the districts of Almora, Dehra Dun, Bhabar, Tarai, Bareilly, Moradabad, Pilibhit and Bahraich. The actual number of cases treated in the Bhabar and Tarai dispensaries in 1886 was 880 as compared with 335 and 355 in 1891 and 1892 respectively. There are thus *seasons in which the disease is sporadic* in character ; and *other seasons in which the disease assumes almost an epidemic form.*

7. The sudden outbreak of goitre among the native contingent of the Duffla Field Force in 1874 was sufficiently typical of the general or epidemic incidence of the disease, and of the period or season of such prevalence generally. This outbreak occurred suddenly in a notoriously malarious locality, in a clearance almost surrounded by dense virgin forest, where the disease was also common among the inhabitants, and during the cold weather and ordinarily the healthiest time of the year (early part of 1874). The soil was damp, penetrating and swampy. The sun was only visible for four or five hours in the day owing to fog. It was often very cold, the thermometer at sunrise standing at from 34° to 38°. The locality of this outbreak was on the Dihing river, a fine broad stream of clear water running over shingle and sand and free from silt. The analysis of the water gave the following results:—

	Grains per gallon.
Total solids	5·04
Carbonate of lime	1·02
Carbonate of magnesia	·28
Chloride of sodium	·46

Sufficient proof of the purity of the supply. The *rapidity* with which goitre developed was simply alarming. Nearly every man in the ranks exhibiting more or less fulness of the thyroid gland *and the force only remained in the locality ten days.* The conditions of this outbreak were quite analogous to another at Pabha Mukh, where the reliefs from Sudiya, on arrival in a small clearance, almost surrounded by dense virgin forest, were *also suddenly* attacked by the disease.

8. The seasons which stand pre-eminently in the North-Western Provinces as seasons in which goitre is exceptionally prevalent, are characterised by exceptional cold, with abnormal fall of snow in the hills, and rain with low temperatures in the affected tracts. The average normal number of rainy days in January and February 1893 in the submontane tracts when the disease first assumed exceptional prevalence was 11·3 as compared with 3·5 in the previous year, and from March to May the normal number of rainy days was 10·2 as compared with 2·0 in 1892. The exceptional prevalence of goitre in the localities of its occurrence is undoubtedly *due to the exceptional cold and dampness of the season* from January to April *in particular years.* The time of prevalence of goitre is from November to March, with a maximum of cases in January and February, and, in certain seasons, the disease reaches an apparent maximum, that is, when the gland is definitely swollen and palpable disfigurement results, as late as April and May.

9. In 1886, when the disease was unusually prevalent, the snow line was below its normal height at the end of January, and there were exceptionally cool periods following snowfall and stormy weather in the hills on 4th, 5th, 18th, 19th, 20th, 21st, 23rd, 24th, 30th, and 31st January. A large amount of snow fell during the stormy periods at the beginning of February and from the 15th to the 17th of the month; and the lowest temperatures of the cold weather and of the year over the whole of India were observed during the week after the first storm. In March the mean temperature was below the average, and during the last fortnight of the month the weather was very rough in the North-Western Himalayas and much snow fell.

10. In 1893, also a year in which goitre was exceptionally prevalent in the submontane tracts, the first quarter was marked by a succession of storms, giving abnormal falls of snow to the mountain ranges and rain on the adjacent plains. January, with its unsettled weather and frequent snow storms, was unusually cold; and the stormy cold weather lasted well into February when a break occurred about the end of the month, lasting till the second week of March, when the characteristics of the previous month again prevailed. April was, on the whole, cold and unsettled, and was characterized by the same abnormal features as had marked the previous months. The weather was unusually unsettled in May with a much lower temperature than usual. The feature of June was an unusually early advance of the monsoon current with abnormally cold weather.

11. In the following tables the mean barometric pressures and average monthly maximum and minimum and average monthly daily range of temperatures, also that actual total rainfall and number of rainy days in the first six months of 1893 when goitre was exceptionally prevalent, with similar data for 1892 when the disease was in its usual sporadic form, are fully indicated:—

Mean monthly 8 A.M. pressures.

STATIONS.	JANUARY.		FEBRUARY.		MARCH.		APRIL.		MAY.		JUNE.	
	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.	Mean 8 A.M. pressure.	Mean 8 A.M. pressure reduced to sea-level and latitude 45°.
1892.												
Gorakhpur	29·819	30·052	29·680	29·908	29·537	29·757	29·484	29·698	29·401	29·613	29·331	29·543
Bareilly	29·486	30·061	29·345	29·911	29·204	29·752	29·134	29·664	29·049	29·570	28·998	29·520
Ranikhet	24·161	...	24·072	...	24·048	...	24·071	...	24·009	...	23·971	...
1893.												
Gorakhpur	29·773	30·006	29·781	30·014	29·685	29·911	29·524	29·740	29·468	29·682	29·364	29 578
Bareilly	29·427	30·004	29·441	30·017	29·356	29·915	29·192	29·727	29·127	29·655	29·024	29·551
Ranikhet	24·079	.	24·089	...	24·118	...	24·093	...	24·054	...	23·982	...

Mean monthly maximum, minimum and daily range of temperatures.

Stations.	January.			February.			March.			April.			May.			June.		
	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.	Maximum.	Minimum.	Range.
1892.																		
Gorakhpur	73·9	50·4	23·5	79·4	54·9	24·5	93·4	62·8	30·6	101·4	75·4	26·0	102·1	78·2	23·9	96·4	79·1	17·3
Bareilly	72·4	47·1	25·3	75·4	51·1	24·3	91·7	58·4	33·3	103·1	73·3	29·8	104·7	79·1	25·6	100·0	79·6	20·4
Ranikhet	58·6	43·1	15·5	56·8	42·3	14·5	71·3	54·3	17·0	80·1	62·3	17·8	81·4	64·5	16·9	78·9	63·6	15·3
1893.																		
Gorakhpur	69·2	48·9	20·3	67·9	49·6	18·3	83·1	58·7	24·4	97·7	71·2	26·5	96·5	75·4	21·1	91·6	77·1	14·5
Bareilly	64·9	45·8	19·1	64·3	46·5	17·8	79·0	54·4	24·6	95·9	67·1	28·8	97·9	74·6	23·3	93·9	76·4	17·5
Ranikhet	48·7	35·0	13·7	46·1	33·7	12·4	57·6	43·6	14·0	72·4	56·1	16·3	74·3	58·9	15·4	74·1	61·4	12·7

Actual total rainfall and number of rainy days.

Year.	Station.	January and February.		March to May.	
		Rainfall	Number of rainy days.	Rainfall	Number of rainy days.
1892...	Gorakhpur	0·77	3	0·48	3
	Bareilly ...	1·76	4	0·46	1
	Ranikhet ...	3·13	5	2·31	6
1893...	Gorakhpur ...	3·02	9	3·43	9
	Bareilly ...	4·40	7	2 41	8
	Ranikhet ...	14 99	17	9 26	19

12. There is distinct evidence, therefore, that the *special climatic and other conditions* with which epidemic goitre is associated, like those which predispose the individual to malarial fever, splenic enlargements and similar ailments, *vary in intensity in a marked degree in different seasons.* In Europe, the disease has been ascribed to the action of the melting snow dissolving out certain unknown constituents of the soil, and the actual use of snow water has been regarded, just as potable water is popularly supposed to be, the principal factor in the causation of the disease. The essential predisposing cause of goitre in India as elsewhere is cold and damp, and during seasons in which such conditions exceptionally prevail, the disease is apt to assume the form of an epidemic.

13. Goitre prevails for the most part in distinctly malarious localities, but may be always altogether absent from distinctly malarious tracts. The disease generally occurs at a time of the year *when there is more or less immunity from such fevers;* and, in its recurrence in the form of general and widespread outbreaks, there are definite meteorological and climatic conditions as stated with which exceptional prevalence can be associated.

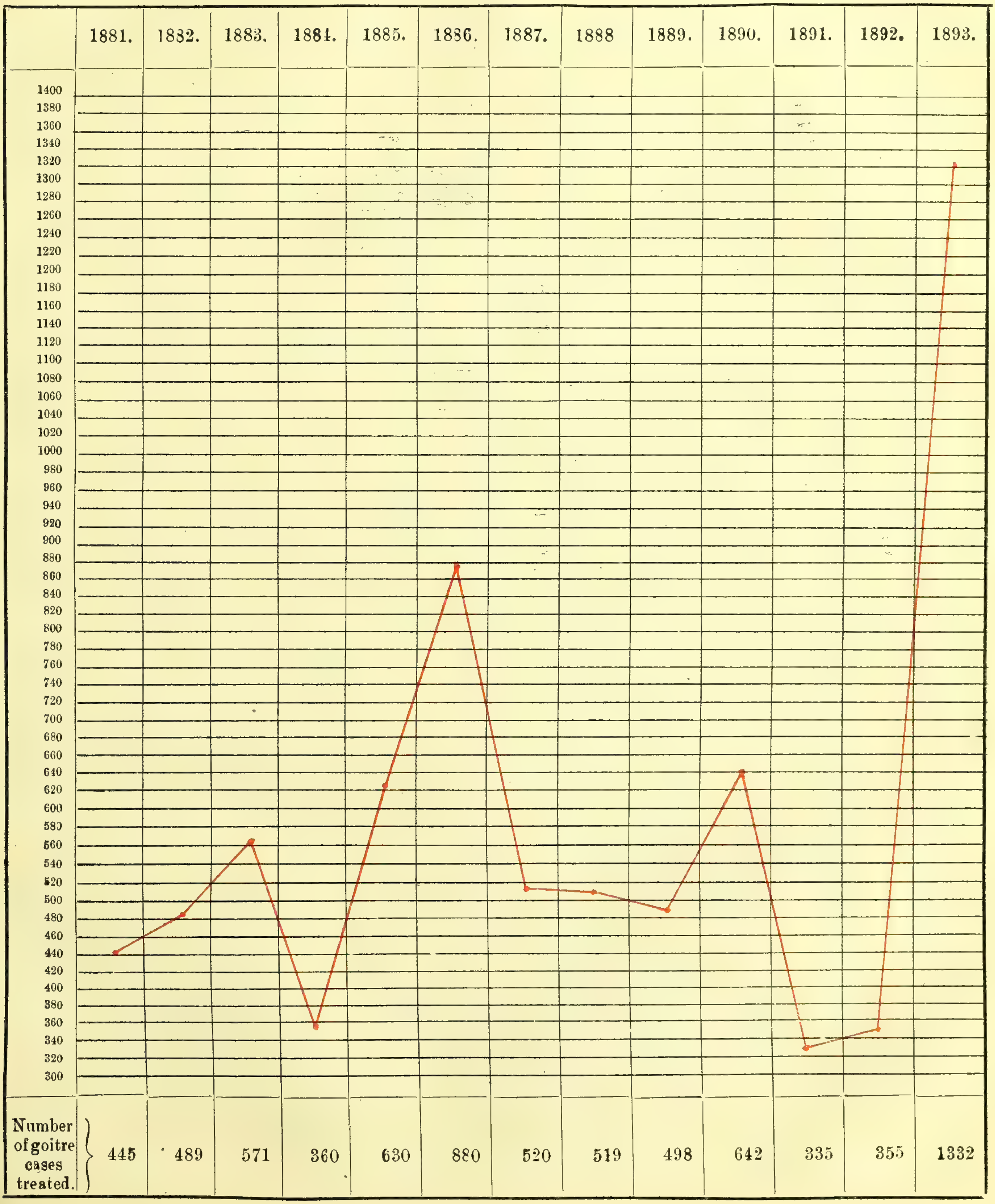
14. The varying incidence of goitre in different years in the Bhabar and Tarai, and its marked prevalence in 1886, a year fairly comparable with 1893 as regards meteorological characteristics, are well illustrated in the diagram attached. *(See page 326a.)*

INFECTIOUS DISEASES IN THE HINDOO KHOOSH.

BY H. B. LUARD,
Surgeon-Captain, I. M. S.

THE valleys of the Hindoo Khoosh are sterile, stony, and dry. They consist of narrow clefts in an ocean of rugged mountains, and only here and there widen out sufficiently to allow of little patches of terraced cultivation clustered round some rude hill fort like tiny oases in a crumpled desert. The climate is practically

Diagram illustrating the prevalence of goitre, as indicated by the number of cases treated in the Bhabar and Tarai dispensaries for a series of years.



rainless, and thus it happens that artificial irrigation, by means of mountain streams, is necessary to make any green thing grow in the valleys.

Many even of the open spaces are from lack of such a stream mere deserts of sand and boulders, on which nothing but patches of wormwood grow, giving maintenance only to the herds of oorial that frequent them when driven down by the snows of midwinter.

You may march for three days in some of these narrow valleys (*e.g.*, on the Gilgit river) without coming upon a green blade or a sign of human habitation.

The result of these natural conditions is, that the population is both scanty and widely scattered, as in all mountainous tracts communications are slow and difficult. Each little community lives in a state of primitive isolation, increased by the rude and piratical habits of some of the tribes (as at Hunza and Chilas), which, until lately, have practically closed those districts to outsiders of every race.

Under such conditions as these, it is natural to expect that the incidence of zymotic disease will be different from that prevailing in civilized and thickly-populated plains, where the close aggregation of men and the facility and frequency of communications enables such diseases to become almost endemic in the soil, and of regular yearly occurrence.

Thus in the plains it results, that it is regarded as inevitable to run through a certain course of childish zymotic complaints. From father to son for many generations these diseases have run their course till the very nature, or at any rate the severity of the disease, in relation to the resisting powers of its subject, have become modified.

In these mountain valleys, on the contrary, such diseases are slow to start, and slow to spread; far from being annual, they may be expected to be of rare and uncertain occurrence. Moreover, when they do occur, they attack constitutions not hereditarily inured against their venom, and should therefore display a native virulence unmodified by habit, somewhat similar to the deadly effect produced by them in a newly-discovered island, though not quite so severe.

These results, which *à priori* reasoning would lead us to expect, are in fact found to be partially true of these regions.

In the last three years the opening up and increasing frequency of communications with Kashmir and the Punjab has enabled me to observe several epidemics, some slight, some severe, of which I will now give a brief description:—

1. *Mumps.*—In the autumn of 1892, many cases of this disease occurred at Bunji amongst the sepoys of the two regiments of Kashmir Imperial Reserve troops (Ramgul and Ragonath), which had that season arrived from Jammu, a distance of more than thirty marches.

The disease was, no doubt, brought up from the plains by them. So far as I was aware, it did not spread to the country villages, though one or two natives employed in the camp took it. The troops lived under canvas away from contact with the villages, and the sick were isolated in separate tents.

The disease presented no peculiar features. Its subjects were young Dogras from Jammu, and young Gurkhas from Nepaul.

Not more than twenty or thirty cases occurred. So I conclude that the disease is one existing in those countries, and that the other sepoys had been through it before.

It again occurred in the autumn of 1893 in the newly-arrived Rogobir regiment at Bunji.

2 and 3. *Hooping Cough and Measles.*—In the summer of 1893 an epidemic occurred amongst the country people in the hill forts of Gor and in the Gilgit District.

It attacked exclusively children, was attended with a rash, sickness, and coughing, and was severe, causing several deaths in each village. I arrived in Gilgit from Chilas when the epidemic was nearly over, but saw one case with a clear measles' rash, and heard in another the typical hooping cough.

The two diseases occurred simultaneously, or closely following one another. Practically all the children under seven or eight were attacked. I learnt that it had spread gradually down the Gilgit river from the north-west, and in this way about two months after reaching Gilgit, it reached the Indus, and spreading down stream attacked the people of Gor in the autumn.

An old inhabitant told me that the diseases usually came together at intervals of from five or ten years.

It would thus be in the habit of affecting the whole population during childhood at one period or another; so that its virulence would be only normal. The apparent severity was, no doubt, due to the accumulation, as it were, of several years' susceptible material, the death-rate of the disease being concentrated, instead of (as in England) spread over every year. There was no extraordinary mortality, considering the scanty fare and want of nourishment that prevails in most of these villages in the early summer before the harvest is gathered in.

Many isolated villages escaped altogether, but wherever it obtained a footing, it ran right through every house.

4. *Typhus.*—This is a disease, which, from *àpriori* ground, one would expect to find in these parts. Like all hill-tribes, the inhabitants are extremely dirty, never washing in winter (*viz.*, for six months in the year), and rarely, if ever, changing their clothes till they fall off from old age.

The houses are without ventilation, low, having only one low opening, about four feet high, the door of which is kept shut during the winter, while a whole family (including, in Hunza, the cows and sheep in an ante-chamber) enjoys the foul air of a space hardly sufficient, in the absence of ventilation, for one.

Here are all the conditions favourable to typhus, yet is was nearly three years before I had the opportunity of obtaining clear evidence of the existence of this disease.

In winter 1891 it was reported that a severe fever, sometimes but not always attended with a rash, had attacked the villages near Astor, at an elevation of about 8,000 feet. The disease spread in families and houses, and several persons died.

In 1894, about March, towards the end of winter, the disease re-appeared in the same villages, and three or four persons died. A little before, a dâk man from those parts, who had been ill some days, was admitted into hospital at Bunji moribund, and died in a few hours. He was said by the hospital assistant, who had seen him earlier, to be suffering from double pneumonia. When admitted, he was too ill to examine thoroughly, nor was a *post mortem* possible; no rash was visible.

A little later another dâk runner came into hospital with a similar fever, from which his family also, in a distant village, were suffering.

This man never developed any rash, though I looked carefully for it; but with this exception he passed through a typical attack of mild typhus, *i. e.*, a continued fever, which lasted fourteen days, with a rapid crisis or decline extending over the last forty-eight hours, leaving him weak, but convalescent. His conjunctivæ were congested; skin dry and burning; tongue furred; bowels constipated; no enlargement of spleen or liver; breathing hurried, and a slight cough, attended by a few moist râles at the bases of the lungs.

Quinine, in ten grain doses, three times a day, for three days, was given, but had no effect; afterwards only a saline draught was given about ten days after his convalescence, the native doctor who had been attending him closely, and who was now at Chilas, 60 miles away, fell ill, with a similar fever, passing through a similar course without any rash appearing. Then another sepoy sickened at Bunji, who had been in hospital with the first case for a different disease, and ran through a typical course without rash. Lastly, another sepoy, his sick attendant, sickened with the same fever. I saw him on the eighth day, and at last in him a most typical typhus rash showed itself, consisting of dusky irregular spots all over his body and limbs. The diagnosis of the disease, which had previously rested on the symptoms, was thus confirmed. In natives such a rash often escapes notice, partly from the darkness of their skins, partly from the envelop of dirt, which (in hillmen) during the winter encases their bodies as with a garment.

About twelve sepoys took the disease; one died on the fifteenth day after the fever had left him. The severity of the above cases was slight, compared with what one sees in Europe.

This may be due to the vegetarian habits and healthy, hardy lives, both of the country people and sepoys; or to the fact that the disease, being endemic from ancient day, has lost some of its virulence.

I treated them expectantly, giving milk and sago diet, saline draughts, cool drinks, occasional tepid sponging, and using alcohol in the late stages with good effect.

5. *Enteric Fever.*—With the exception of one case (an European officer who died in March 1894 at Gilgit), which did not come under my observation, I have heard of no case of this disease in these parts.

The sanitary conditions, though imperfect, are such as are very unlikely to produce or harbour this disease.

All inhabited parts are on terraced sloping hillsides, with pure mountain streams falling down in cascades and rapids straight from the snows as the main water-supply. It is true this water is in some places collected in tanks, liable to fouling: but even the tank water is constantly renewed by fresh water flowing continuously in.

The want of rain makes the air and ground so dry that excreta, which natives and sepoys pass in some dry stony recess at a distance from their habitations, dry up rapidly and are disintegrated without causing any nuisance or infecting the soil.

In Hunza in the spring of 1892, at an elevation of 8,000 feet, I saw several cases of a form of continued fever, the nature of which I could not quite determine. It occurred in February and March, when severe frost had been continuous for many weeks, and attacked (1) two or three sepoys living under canvas in camp; (2) the native commandant living in a separate tent; (3) the Thum or Raja of Hunza, Mahomed Nazim Khan, who lived in his own mediæval castle—all recovered. It consisted of a mild but continuous fever, lasting about ten days, ending in a gradual decline spread over three or four days, unattended with any visible rash, slight cough and congestion of lungs, constipation, no enlargement of spleen. I am inclined to attribute it to typhus, not enteric, in view of the above symptoms, although not typical, especially considering that the sanitary conditions of these parts are distinctly provocative of typhus, while almost negativing the possibility of enteric occurring. I hold the opinion that the latter disease is as yet unknown in these parts. I have also seen cases of severe continued fever in the summer, both at Bunji and Gilgit, lasting as long as three weeks or more, untouched by quinine, with slight enlargement of spleen, constipation, no trace of rash, and extreme exhaustion and muttering delirium. Though bearing many resemblances to enteric, I believe them to be malarial in origin. They all recovered under careful nursing and diet.

6. *Cholera* has occasionally penetrated to these secluded parts. The last time was about seven years ago. The natives say it was terrible and sudden. A man was quite well, when water began to pour from his mouth and anus, great pain seized him, and in one day he was dead. It attacked Astor, Bunji, and Gilgit, and killed many people; but did not spread to the outlying or remoter villages. It was undoubtedly imported from Kashmir; it lasted but a short time, and did not reappear.

The same natural sanitary advantages which prevent the occurrence of enteric protect these parts against cholera, so that even if it were introduced again it would be easy to isolate it and stamp it out.

In 1892, when cholera raged in Kashmir and when hundreds of muleteers and coolies passed from Kashmir to Gilgit, the disease did not spread. A case or two occurred on the top of the first pass; but the good sanitary arrangements, quarantine, and careful inspections made by the officers in charge of the transport at Bandepore and on the road prevented the disease from invading our borders.

7. *Small-pox.*—This disease from time immemorial has at long intervals of from five to twenty years invaded these villages, the inhabitants of which protect themselves against it by inoculation. But as the epidemics occur at long intervals, a large amount of susceptible material accumulates, and as the inoculation is practised under the stimulus of immediate danger, each epidemic finds many victims before this practice stamps it out. Inoculation is practised by the mullahs, who take a dry small-pox scab a year old, ground it in

water, and with this material make a single inoculation on the wrist.

This method often inoculates septic material as well as small-pox virus, producing large suppurating sores; and in some cases of this kind protection does not occur, owing, I suppose, to the small-pox virus being crowded out in the struggle for existence by other septic germs, and so not taking effect.

In 1891, small-pox spread gradually up the Indus valley to Chilas, and in the autumn kept the Chilasis quiet during the Hunza-Nagar expedition. Thence it spread to Bunji and Gilgit by Christmas. At this time we had just sent 117 prisoners taken at Nilt to Gilgit in chains. These were shortly afterwards released, but took back with them to Hunza and Nagar the germs of disease, several of them evidencing immediately on their arrival at their homes. Hunza-Nagar had not been visited by the disease for over twenty years, so much susceptible material existed, and a very severe and fatal epidemic ensued. In the previous year a native hospital assistant from Gilgit had vaccinated a good many people in Hunza, but not in Nagar. Hunza was but slightly visited by the epidemic, and though a certain small proportion of the Hunza cases occurred in persons vaccinated, most of these cases were mild; and of those which were severe, I found reason to think the vaccination had not been very efficiently performed, the scars being thick, fleshy, and not properly puckered. Probably the vaccination had been accompanied by septic inoculation, thus preventing the vaccination from taking effect.

In Nagar, where no vaccination had taken place, the epidemic was very severe; some villages were half depopulated, and the disease was generally confluent, numerous deaths occurring, *e.g.*, in one village of about thirty houses fifty deaths occurred. Unfortunately no vaccine was obtainable from Gilgit, and the passes were closed. After waiting in vain for it, I tried to produce a new supply by inoculating calves with small-pox lymph. Three calves were inoculated at different times with virus from pustules on the 3rd, 4th, 5th, 6th and 8th days of the eruption; the lymph being inserted near the nipple of the udders. The experiment failed. In no case did any perceptible result ensue. A similar result was also obtained at Gilgit. I then ordered universal inoculation of the country people, which they were only too ready to adopt. The effect was most striking. With the exception of a few cases which already had the germs of the disease in them, no fresh cases occurred. Within a fortnight small-pox had practically disappeared, only a few convalescent cases remaining. This practice was justified by its results, and by the absence of vaccine. The simultaneous and universal application of it, in a secluded district, took away any danger there might be of spreading small-pox by its means; and this objection is the only valid one against inoculation that I am aware of. The effects of inoculation were invariably an exceedingly mild disease. A local reaction, similar to vaccination, took place, becoming mature about the ninth day, at which time a very few scattered pustules appeared on the body, with an insignificant fever not lasting over three days. These secondary pustules were not only few in number, but modified in appearance, small, and rapidly aborting. No death occurred from the modified disease. Just as the inoculation had been begun a small supply of vaccine arrived. All the officers in the Gilgit district, except one who was out on tour, were then revaccinated. None took the disease except this officer, who had a severe attack of nearly confluent small-pox, which however aborted on the twelfth day and he recovered. He had been vaccinated in infancy, but no scars were visible. Still this may have been the reason of his escaping the last two days of the unmodified disease. I did not vaccinate myself, as I knew I was already sufficiently protected by previous vaccinations and residence in a small-pox hospital. The troops entirely escaped: most of them had been either inoculated in infancy or recently vaccinated; and they lived in an open camp at some distance from the villages.

8. *Influenza.*—An epidemic of this disease at Gilgit was recorded by Surgeon-Captain J. R. Roberts in 1890, but I have never myself seen it here.

I have, however, seen twice in the winter, among the troops under canvas in Chilas, a slight epidemic of ordinary catarrh, unattended by any prostration, high fever, or complications.

9. *Pneumonia.*—This disease may, I think, be classed under the infectious diseases.

It is rare up here, not a single case occurred on the march of the 5th Gurkhas in 1891, when the cold was severe, and many men were frost-bitten; nor did any case occur in the Hunza expedition, when the force was for some time bivouacked without tents in midwinter at an elevation of about 7,000 feet. These instances almost dispose of the question of cold as an actual cause of the disease. I attribute the popular idea on this subject to the rigor which often ushers in the disease, and is hastily mistaken as its cause.

During the winter of 1892-93 on the Chilas road, the force, even when bivouacking for a long time without tents and undergoing severe fatigue, was almost entirely free from pneumonia.

The exception occurred, *viz.*, four cases in one of the posts among the Balti coolies, raftmen, and other followers, who, on account of the cold, were quartered in a deserted village, in small ill-ventilated huts, from which they carefully shut out all access of fresh air. When the sick were isolated, and measures taken to distribute the followers over a larger air-space, the disease ceased, and the sick recovered.

The troops bivouacked in the open close by remained healthy.

Two cases of pneumonia occurred during the operations in Chilas in the spring of 1893.

They were attributed to a sudden downpour of rain lasting two days, which was quite unexpected in this dry climate; two men, being at that time housed in grass-huts, got wet and cold; both recovered.

The fine dry air of this climate seems to be particularly unfavourable to the occurrence or dissemination of pneumonia.

10. *Leprosy.*—I saw one case of tubercular leprosy in Gujal beyond Hunza; but have never seen or heard of any other, except two cases Surgeon-Captain Roberts met with about three years ago at Gilgit.

11. *Tubercle.*—I have seen two or three cases of tubercular lungs in Gurkha sepoys up here, but none amongst the country people. One of these cases was severe, attended with hæmoptysis, fever, emaciation and sweats, and lasted many weeks; but eventually this case which occurred at Bunji at an altitude of 4,500 feet was transferred to the Astor hills at an altitude of 9,000 feet, and there he completely recovered, and is now doing duty.

Another case, a native officer, also a Gurkha, suffered from extensive tuberculosis of the submaxillary lymphatic glands, became anæmic, debilitated, and had night sweats. He, too, when transferred to the hills, gradually amended, and is now quite well and doing duty.

The air of the hills here is peculiarly favourable to the recovery from tubercular disease, being dry, cold, and clear.

12. *Venereal disease* is rare both amongst troops and country people. I have never seen a hard chancre here, or secondary eruptions. A few cases of soft sores in troops recently arrived from Jammu and a few cases of gonorrhœa confined to Gilgit itself, are the only venereal disease I have seen in three years.

I have heard, however, that the villages about the Burzil Pass are largely infected with syphilis.

13. *Infectious disease of wounds.*—Of these I have seen two isolated outbreaks.

(A) *Tetanus* occurred in 1891 at Astor amongst the frost-bitten followers in hospital there. Three cases occurred and all died. They were housed in an old village, and were somewhat crowded together. The large amount of ulcerating stumps and mortified parts, giving rise to profuse and foul discharges, was no doubt a favourable opening for tetanus germs, which may have been long resident in the dust of these old houses. When the injured men were spread over a larger air-space, and strict measures for cleanliness and disinfection taken, the disease ceased at once to spread.

(B) *Wound Diphtheria.*—In the third week after the action against the Kohistanis at Chilas in March 1893, six of the wounds became infected with a typical form of wound diphtheria. The discharges dried up, the parts surrounding the wounds swelled up and became very painful, and high fever occurred. The surface of the wound covered by a thick, white, firmly adherent membrane. I isolated them at once, spread the remainder of the wounded over a much larger air-space (all were under canvas from the first), and forbore to open the other wounds for a few days, allotting separate dressers and instruments for the healthy and unhealthy cases respectively. By these means the disease was prevented from becoming epidemic, and no further cases occurred. The diphtheritic wounds were treated by freely scraping away under chloroform both the membrane and all the soft granulations underneath, which bled freely, being very vascular. The whole surface of the wound was then cauterized with pure carbolic acid. This treatment completely arrested the disease, and the wounds were in a healthy granulating state and the temperature normal within a week's time. The diagnosis of wound diphtheria was rendered the more certain by the following incident:—

A wounded officer accompanied me through the sick-tents to see the wounded the day the first case occurred. Next day his temperature rase to 103° F., and he complained of sore-throat, and the day after there was an undoubted patch of diphtheritic membrane on one of his tonsils. I treated this in the same radical way as the wounds by scraping off the membrane, and then applying pure carbolic acid daily for four days. At the end of a week, he too was quite well again. His wound, which was in the scalp, remained healthy, and free from infection throughout.

(C) *Jalkat Sore* may, perhaps, be added to the list of infectious diseases of wounds, as it was in all probability due to inoculation of some virus on the punctures caused by the Chilas flies. This was a peculiar kind of frontier sore, several cases of which occurred in Chilas in December 1892. It took the form of a red inflamed pimple, occurring either on the trunk or on the extremities, which rapidly enlarged, till, on the second or third day, there was a large sore, an inch or more in diameter, standing out above the level of the skin, with a flat top, black, and covered with blisters containing a clear blood-stained fluid, a sharply defined zone of intense redness half inch broad surrounding the sore. It was accompanied by high fever and malaise. This kind of sore is said to be common at Jalkat down the Indus, whence its name. It also occurs in Punial and Skardoo. It is generally single; occasionally more than one. The Punialis treated it by freely cauterizing it with a red-hot ember. The centre of the sore then sloughed out, and the base rapidly granulated and healed. I treated one of the sores in an expectant manner by poultices, good diet, etc., in order to observe its course. It slowly spread at one (the lower) margin, where diffuse abscesses subsequently formed. It partially healed on the opposite margin; fever continued high for about ten days, after which the slough separated; the sore remaining soon granulated up and healed. The abscesses were incised, drained, and soon healed.

It is said to be very fatal, but none of my cases died. The cautery appears an excellent treatment. No infection could be traced, the infected persons not having slept or eaten together; but the sores had all the appearance of acute infection by some morbid micro-organism. Very possibly this contagion is carried by the small and venomous Indus Valley flies, which infested every camp along the Indus in the autumn and spring, disappearing in the extreme heat and cold. Its bite raises a small blood-blister, which is painful and itchy on the second, third and fourth days afterwards.

14. *Infectious diseases of sheep and cattle.*—During the last four years large flocks of sheep and goats have been imported every autumn for the use of the troops

from Kashmir. In three out of the four years pleuro-pneumonia has broken out and continued through the winter, causing great losses; and this disease, extending to the flocks of the country people, has caused great loss to them also, both in Astor, Bunji, Gilgit, and Hunza. They depend on their flocks for wool for their clothing, for milk and ghee, and for manure for their fields: so this loss tells very heavily on them. I confirmed the diagnosis of the disease in 1893 and 1894 by *post-mortem* examination. In 1893, foot and mouth disease was brought up from Kashmir by the bullocks employed in the transport service. Some of them died; others were sold by their owners, and spread the disease amongst the herds of the country people in Astor, Bunji, Chilas and Gilgit, both cattle, sheep, and goats being affected, causing considerable loss. In 1894, rinderpest was brought up from Kashmir by the transport bullocks, of which many died. It spread to the country herds and destroyed probably at least two-thirds of the country cows and oxen. The loss of the latter tells very severely on the country people, as they depend on them for ploughing their lands and for treading out their corn, as well as for manure. The diagnosis was confirmed by *post-mortem* examination. All the characteristic signs of rinderpest were present.

Flocks and herds constitute, in the eyes of the country people here, their sole wealth, without which even the possession of land is regarded as worthless; so it is to be hoped that the commissariat animals at Bandipore may, in future, be properly inspected by a *Salutri*, so as to prevent these epidemics which are so ruinous to the unfortunate people here. This concludes my account of infectious diseases in the Hindoo Khoosh, which I hope may prove interesting to others, on account of the peculiarity of the local conditions as compared with the plains.

CHOLERA AND QUARANTINE.

BY P. W. O'GORMAN,
Surgeon-Captain, I. M. S.

Quarantine has been defined as—"The enforced isolation of individuals and certain objects coming, whether by sea or by land, from the place where dangerous communicable disease is presumably or actually present, with a view of limiting the spread of the malady. The objects liable to quarantine include—on the assumption of their being apt to carry the contagion or infection of the disease—the luggage and personal effects of the individuals isolated, certain articles of merchandise and ships; and, inland quarantine, carriages and other vehicles. Sometimes entire communities and districts are subjected to quarantine.—(Quain's *Dictionary of Medicine:* article "Quarantine.") Ordinarily, the word "quarantine" is colloquially employed to designate any restrictive or detentive measure taken at frontiers or ports of entry, &c., to arrest contagion by land or sea. Quarantine may be divided into (I) *Maritime* and (II) *Land-quarantine.* It may, further, for practical purposes, be classified into:—

(1) *Ancient quarantine.*—Meaning the unconditional arrest and detention of all vessels or individuals arriving from any infected locality, until, within a period of forty days or less, the presence or absence of the disease was proved by lapse of time.

(2) *Limited or rational quarantine.*—The examination conducted to ascertain the presence or absence of cause of communicable disease, without detention for more time than is necessary to the discovery and the destruction or removal of such causes.

(3) *Medical inspection.*—The medical inspection of vessels, railway trains, etc., or individuals coming from an infected locality, without detention of "healthy" vessels, persons, &c.

"*Infected ships,*" etc. (with a case on board or with fresh cases during preceding seven days), are to submit to (*a*) disembarking and isolation of the sick; (*b*) the others to remain "under observation" not exceeding five days; and (*c*) disinfection of passengers' property as well as the ship, train, etc.; (*d*) emptying of water tanks and pumping out bilge-water after disinfection; and (*e*) delayed disembarkation of crew.

"*Suspected ships,*" etc. (having had cases, but with none during the last seven days), are to submit to (*a*) medical inspection; (*b*) disinfection; (*c*) substitution of good drinking water for stored supply: and (*d*) pumping bilges dry: the last two before entering dock.

In England the "observation" is carried out in the homes of the persons concerned, notification for same being conveyed to the local sanitary authority: pauper aliens and persons from infected ports, who are either filthy or unwholesome, are prohibited from landing.—(Orders of Local Government Board, September 6th 1892.)

The above is more or less the substance of the agreements drawn up by the International Conference on Cholera Quarantine at Dresden in 1893.

I briefly offer a few suggestions on land quarantine, as we become acquainted with it in India in its particular application against the visitation of cholera.

In spite of the advancement of science the propagation of cholera is still enigmatical.

We have come to regard atmospheric "waves" as mythical, and are asked to put our faith on the "comma bacillus" of Koch. But instances still arise to question the wisdom of such absolute dogmatic teachings.

In the recent pandemic, still progressing in Europe, can we say that the rapidity of spread can be satisfactorily accounted for by what we know of the life history of Koch's bacillus, its incubation, its rapidity of multiplication, and so on? And what are we then to think of those very numerous cases where the "comma" exists abundantly without producing cholera? And where cholera has been produced without its presence at all? Thus Rumpp in Hamburg, Lesage and Macaigne of the Institute Pasteur, Metschnikoff, Lubersch and others are quoted as having proved that true Asiatic cholera occurs without the comma bacillus; and the negative experiments of Pettenkoffer, Emmerich, Stricker of Vienna, and Klein that the comma bacillus may be toxic, but there is still no positive evidence that it produces cholera. Klein has written a book to prove this, and since then has shewn (*Indian Medical Gazette, 1893*) that similar toxic symptoms are producible, and similar immunity imparted, by the typhoid bacillus of Goffky and Eberth, the bacillus coli communis and others. That choleraic symptoms are not solely characteristic of Asiatic cholera is, I presume, well known. English cholera and ptomaine poisoning from various causes are examples. In the year 1887, in Bristol, England, I attended a case with typical symptoms of cholera. I never saw stools more typical, and the only probable cause was defective cheese. There was no cholera in Europe that year. Again, in May 1889, in Allahabad, I attended a native officer suffering from typical cholera symptoms—cramps, thirst, suppressed urine, vomiting, rice water stools and collapse, etc., ending rapidly fatal—and although the regiment had only a week before returned from their cholera camp, where they had been sent on account of cases having appeared among them—my suspicions were aroused and the *post mortem* satisfied me that he had been poisoned with arsenic, and this the chemical examiner soon confirmed.

Mr. Ernest Hart claims with great reason to have established on an overwhelming basis of evidence collected from every part of Europe the dicta founded by Snow and Simon on the British epidemics of 1848 and 1854, and by himself and Radcliffe of the East End London epidemic of 1866:—

(1) That cholera is a filth disease, carried by dirty people to dirty places, and diffused by specially poisoned water; (2) that you may eat cholera and drink cholera, but you cannot catch cholera; (3) that cholera may be considered for all practical purposes as an exclusively water-carried disease, and that it is carried only by water poisoned by human discharges.

Now, these are factors that nobody scarcely can deny, proofs being overwhelming. But yet, though the truth, in my humble opinion they are not whole truth. Surgeon-General J. M. Cunningham has traversed them and denied them. But I think that it is important to recognise that, although cholera is, in the vast majority of cases, a "water-borne" water-communicable disease, *yet it is not always so, not invariably so.* Instances to the contrary cannot, I think, be gainsaid.

Dr. Lanson, Inspector General of Hospitals, at the London Congress in 1891, drew attention to the fact that there are now no inconsiderable number of instances of well-marked epidemics having sprung up in limited localities at a long distance from where the disease was already prevailing, and among persons who had not been absent from the locality for months, *without its having been possible for them to have had personal communication, either direct or indirect, with any one already affected.* And he instances the investigations by Dr. Parkes at Southampton in 1856, by Mr. Radcliffe at Theydon Bois, Essex, in same year, by the Board of Health in New Orleans in 1873, by Mr. Fannel, and Drs. Bourdel, Proust and others at Toulon and Marseilles in 1883. *In none of these was there any trace of communication by sick or fomites*, and Dr. Lanson concludes that ' the efficient cause of the epidemic of malignant cholera can be conveyed to localities a great distance from where it is already prevailing, in sufficient quantity to generate an epidemic, without being carried by man or fomites.

Again, at the recent International Congress at Buda Pesth, Dr. Clemow, who has investigated this subject in relation to Russia in particular, says: "After reading some scores of Russian reports and pamphlets, and many articles in Russian medical journals, the impression left on my mind is that, so far as the recent epidemic in Russia is concerned, there were numerically more persons who contracted cholera by direct and unguarded intercourse with the sick than by means of drinking water, and that the poison of cholera was less often introduced into a new locality, and less often spread in that locality by means of water, than by persons suffering from the disease, by careless contact of the healthy with the sick, and by articles that had been soiled by the dejecta of the sick." But although he acknowledges water as the frequent cause of spread, he disclaims asserting that it will explain all that is obscure in connection with the disease.

"It will not explain why cholera is one year confined to India and another year spread to half the civilized globe. It cannot account for every outbreak in every village or town in which cholera occurs."

We now return again to quarantine and ask is it never advisable? The ultramontane anti-quarantine party contend that quarantine can never, under any circumstances, be justifiable, for the simple reason that cholera cannot be kept out of a country because it is communicable by, let us say, "aërial waves" (or aërial currents), which necessarily supersede and abort all such efforts of man, and that therefore our only refuge and hope lie in good water-supply and thorough sanitation. That there is enough ground for this contention I have already shewn. But that this is the whole truth is open to question. I am no general upholder of rigid quarantine with its cordons and police, its false sense of security and its neglect of hygiene and sanitation; but I decidedly incline to the opinion that, under certain circumstances, a modified quarantine is often perfectly effectual in arresting advance of disease, even into a sanitarily defective locality. Although this protection is not always evident, it yet occurs frequently enough to demand introduction wherever practicable. Such has been more or less the time-worn practice in India, with our army, our cantonments, our jails, and our municipalities. And experience has not proved us false. This modified quarantine is by no means intended, nor in practice is it used, to supersede hygiene and sanitation. In our first three examples they are nowhere, perhaps, in the world, more strictly enforced, but it is an *additional precaution* of great value that the special exigencies of the case demand, and much responsibility is incurred by those who decline to accede to the dictates of our past experience. And, as a matter of fact, there is no nation on the globe that does not uphold some system, however modified, of principle of quarantine.

The following propositions, therefore, may be enunciated:—

(1) *The degree of protection which quarantine can afford is inversely as the case of communication and amount of traffic between the infected country and the country to be defended.*

(2) Quarantine can best yield a *protection commensurate with its cost only* to countries whose internal sanitation is good, and in proportion to the perfection of the same.

(3) Countries suffering under defective sanitation may also frequently be more or less completely protected by efficient measures of quarantine.

(4) The function of quarantine, if it cannot exclude infection, is to lessen the entering number of foci of infection, and to take instant measures to isolate and arrest their diffusion when entered.

(5) Countries whose internal organisation is not perfect cannot afford to refer the observation of suspects to the country at large.

Surgeon-General Cunningham has said : "No case can be adduced in which the exemption of any country can be proved to have been due to quarantine, or admitting that in a case of this kind absolute proof is difficult and perhaps impossible, no instance can be adduced in which there are good grounds for believing that such exemption has been due to quarantine." I believe I can adduce at least one instance.

In 1892, after the Hardwar *melâ*, cholera spread throughout India and extending into Afghanistan and Persia, assumed pandemic proportions as it progressed throughout Europe. I was medical officer of the Mushkaf-Bolan Railway, in course of construction, and some 6,000 to 7,000 coolies were collected for work along 18 or 20 miles in the Upper Bolan Valley. The Bolan Pass in about 60 miles long. Even before the Hardwar fair cholera was prevailing in Persia and in Kandahar. On the 25th April 1892, cholera broke out among a camp of 400 or 500 railway coolies at Mudgorge in the Pishin valley, and some deaths occurred. Special precautions were taken, and coolies from the affected locality were prevented access to Quetta, and it did not spread there. Cholera began also to prevail in the villages beyond the eastern entrance into the Bolan Pass in the first and second weeks of April, and afterwards spread among the nomad Bruhi encampments thereabouts, causing many deaths. On the 21st April cholera was imported into the Bolan by a Bruhi *reis*, who however made his exit out of the pass towards Khorasan by the Gesthari route at the mouth of the Upper Pass. I heard his village had placed his camp in quarantine, and he had had several deaths. There were no coolie encampments within 14 miles, so they were not affected. But, on or about 26th April, harvesting Brinhishads infected a couple of large villages in the Lower Bolan, where, up to 15th June, about 55 cases with 42 (or 76 per cent.) deaths occurred. At the mouth of the Upper Bolan five cases and five deaths occurred. In the Lower Bolan generally, altogether (from Pirchowki to Bibi Nain), including those within the mouth of the Upper Bolan, some 92 cases were recorded with 63 or 68·4 per cent. deaths, and these in rather a scanty population. On the 26th May, a case in a hospital subordinate, who had been ordered on duty, was imported into Hirok, in the centre of the Upper Pass, from Kirta, and another on the 17th June, by train from Sibi. Both were promptly isolated and every precaution taken, and the disease did not spread. They recovered. By special police arrangements I found that in 32 villages or stations from the 25th April, the total number of cholera cases on the Sibi-Hirak Railway line and villages immediately around the eastern end of the Bolan, amounted to 453 with 320 or 70·6 per cent. deaths. The epidemic extended up to 2nd July, that is, for three months. On the 28th April the pass was blocked. All travellers coming up the Bolan were reported to have been stopped and directed to go by some other route; but Bruhis from infected villages, including Kirta, were not all removed from the Bolan until the 6th May, several of them in caravans being turned back even from the Upper Bolan, on representations to that effect. That it was true cholera with numerous seizures (*sic*) I satisfied myself by personal visits. This rigid exclusion from the pass, especially the Upper Pass, where the coolie camp existed, proved entirely and completely successful. Not only did no case (other than the two importations) occur in the Bolan here, but none were imported into Quetta, nor into the Quetta District. And this, too, considering the circumstances, was very remarkable, for this year was a notably pandemic year. From what I could ascertain cholera was more extensively and virulently prevalent among the Bruhis and villages than in the year before. There was a far greater assemblage of Afghan, Punjabi and other coolies in the pass (by no means clean people) than in previous years; and the year before, a probably less inviting and certainly less generally epidemic year, not only had cholera penetrated into Quetta, but caused heavy mortality even among the European troops. Of course in the pass sanitary precautions, as far as possible, were in force, and the water-supply, although from numerous open springs, was, in great part, in the higher Pass, also protected by conveyance in pipes. But these do not detract from the prominent facts already stated. Indeed, the water-supply of Quetta is also very good, though the cantonment suffered so heavily the year before.

I. Thus I claim that through quarantine measures, under peculiarly inviting conditions, with a preparatory epidemic the year previous, and in a pandemic year of great virulence, an important part of British Baluchistan was effectually protected from cholera. And not only this: that, in contradiction to reports to the contrary, the Bolan Pass and probably the Khojak, which it feeds, must be held on this pandemic occasion innocent of the advancement of cholera towards Kandahar and Afghanistan, and thence through Persia to Europe.

II. I may, I think, also instance the entire protection of the Samana garrison (of 3,500 troops and 2,000 followers, on the Miranjai Hills) after the expedition of that name, in the summer of 1891, although some half-dozen cases did occur in the valley camps on which they solely depended for communication and supplies, modified quarantine measures were adopted on conveys from cholera-stricken Kohat, and effectual steps taken to prevent importation of the disease hillwards.

III. A more recent instance is the Midnapore Central Jail, population 900. Special quarantine-like-isolation measures on new prisoners have been instituted, besides careful supervision of town supplies, to minimize the possibility of importation of infectious disease. The results are given below compared with the adjoining town of 32,000 inhabitants:—

YEARS.		CHOLERA CASES.		CHOLERA MORTALITY.		TOTAL MORTALITY (all diseases).		REMARKS.
		Town.	Jail.	Town.	Jail.	Town.	Jail.	
1890	..	..	2	63	*Nil*	805	38	
1891	..	..	1	125	*Nil*	1,248	23	
1892	..	..	15	454	8	1,378	52	
1893	..	..	6	33	2	981	56	
1894	..	217	*Nil*	182	*Nil*	966	41	

The last two instances are, however, founded on reasonable presumption.

The case of Baluchistan is, I think, established.

CASES BENEFITED AND OTHERWISE BY HILL CLIMATE IN INDIA.

BY ARTHUR JOHN WEATHERLY, M.R.C.S., L.R.C.P.,
Kurseong.

LET me begin by saying no cases of dysentery, convalescents from acute congestion of the liver, advanced phthisis, and advanced organic heart disease should be sent to the hills. It might seem superfluous to say this if I had not over and over again seen such cases sent up.

With the very utmost care as regards food and water and hygienic surroundings, most cases of dysentery, whether acute or chronic, go steadily to the bad, especially if in the hills in the rainy season; but if after patients are thoroughly cured of the dysentery they come to the hills, they generally pick up quickly and seldom have any relapse.

Though acute cases of congestion of the liver do badly, slight cases do well enough with care, the risk being in chills, and abscess, following acute congestion, is fairly common. The congestion of the liver coming on with or in the course of malarial fevers does well as a rule, though I have had several obstinate cases of malarial fever, with congestion of the liver, coming to the hills in the cold weather, which have resisted all treatment, but which have done well from the moment they got down the hills, and have been better, in spite of the journey, before reaching Calcutta, and a sea voyage has in each case led to permanent recovery. Cases of advanced phthisis ought never to be sent to the hills, and only early cases in the cold weather. The advanced cases I have seen here all got very rapidly worse, though the early cases have done very fairly well in the cold weather, if bright and dry. From a personal knowledge of the climate and country, I cannot too strongly urge on medical men in India, when at all possible, to send their phthisical cases to the Orange Free State of South Africa. Over and over again, when in South Africa, and before and since, have I seen this disease cut short by a residence in the high dry Karoo land of the Cape, and every day accommodation for invalids is increasing, and railways run from various Cape ports right into this country. Though I have had one exceptional case of advanced organic disease of the heart do well here, yet, as might be supposed, such disease not only derives no benefit but gets rapidly worse. I have had some few cases which have developed enteric fever symptoms *shortly* after coming up from the plains, but all have done very well, and so do convalescents from enteric, if careful to guard against chill, and after all enteric symptoms have disappeared, such cases regain their normal health remarkably quickly. All malarial diseases and fevers, whether called "malarial," "bilious remittent," "typho-malarial," etc., showing by the effect of quinine whether they are malarial or not, and diseases with any malarial taint, except dysentery, and if with no *advanced* consequent organic disease, do very well; and for all such cases the benefit derived from a hill climate is great. Even with a moderately enlarged liver such cases do well, and I have seen some cases of enormous splenic enlargement from malarial poisoning get rapidly well. Cases, however, of splenic enlargement with marked anæmia require a long *sea* voyage, such as the voyage round the Cape home, if fresh meat, milk, and anti-scorbutic remedies are carried.

Rheumatism is uncertain, some cases doing remarkably well and others badly, and the same may be said of asthma, some of the latter cases never getting an attack while in the hills, while always suffering more or less in the plains, and *vice versa*. A good deal depends on the time of year such cases are sent up.

Cases of anæmia are much benefited if taking things easy at first and leading a lazy life and not lured by the bracing air into over-exertion and chills. Cases of syphilis can be safely put on a long mercurial course in the hills with no bad results, if not much deteriorated by long plains residence. Chronic bronchitis does not, as a rule, do well in adults, though children recover well and easily. All functional diseases of the stomach do well, as also gastric catarrh.

Cases of menorrhagia do well if malaria is at the root of the trouble, otherwise treatment is disappointing. Other diseases of women do well, though in very many cases a short change to Europe does more permanent good than a long trip to the hills, various other causes operating to make the former more useful.

If for any reason mental cases cannot be sent out of India, then unquestionably a hill climate improves the patient; if in nothing else, at least in tone and physical strength. Unless unusually robust, I think confinement cases ought to be sent to the hills; though, of course, the journey is against this in many cases.

It is risky to send cases of diarrhœa in adults to the hills, especially as the rains begin, whereas in children, especially young infants, the worse the diarrhœa the quicker they come to the hills the better, especially if weather is very hot in the plains. Case for operation, except liver abscess, do well. Finally, all cases of nervous exhaustion, general debility, boils, carbuncles and skin diseases from long residence in the plains do exceedingly well in the hills, and if some of them do not get quite cured, they derive great relief till such a time as it is convenient, or the season suits for them to take a long sea voyage, or residence in Europe to complete the cure.

It may not be out of place to mention those diseases very rarely seen among residents in the hills. These diseases are enteric fever, diptheria, and rheumatism, while heart and kidney diseases are very uncommon. Diseases of the nervous system are far less common than in the plains, and lung diseases nearly always to be traced to some great carelessness. Among visitors, "hill" diarrhœa is unfortunately rather common, whereas residents rarely suffer in this way.

A most common hill disease, and one apt to be overlooked in Europeans, and often disguised by symptoms totally different to those described in our text-books, is round worms.

To recapitulate then, no advanced cases of organic disease should be sent to the hills, except splenic disease, if not too chronic, and if a sea voyage is impossible.

And here let me point out a use of the hills as a halting place till such a time as cases requiring sea air or a change to Europe or out of India can get such change.

It is not always convenient or suitable to send such cases at once to sea; for how often do we not see deaths on board steamers a few days out, or patients arriving in London only to die a week or so after in some hospital. I think, therefore, the hills should be used oftener as a temporary halting place till such a time as it can be more clearly seen that a sea voyage will do good, the time of year, time of arrival in England or elsewhere often not being taken into consideration in shipping unfortunate patients off at a moment's notice.

Finally, let all medical men in sending cases, however trivial, to the hills, insist on their patients taking the very strictest precaution against chills in the way of clothing and changing such clothing at once after exercise, for it is this liability to chill and this carelessness in guarding against it which makes the hills less of a sanitarium than they should be, and leads to hill diarrhœa and dysentery and other complaints, which need very seldom happen if proper care be taken.

ABSTRACT.

Dr. J. Morton, in a paper on "Missourie as a Health Resort," said that the temperature resembled that of Western Europe, that it never fell below zero. In point of situation and climate, only Missourie was superior, in his opinion, to any hill station in India. From its situation and medium height (7,433 feet), it afforded the beneficent influence of an inland Himalayan climate, which consisted in a diminshed atmospheric pressure, rapid evaporation and protection from all but S.-W. winds. The average rainfall was 90 inches with 8 inches snowfall. Missourie was the safest place in India for cholera, only a few imported cases have occurred within the last ten years. Tuberculosis in its early stages was much benefited, and even in advanced stages he believed life was prolonged, as in one case quoted. Cancer is rarely met with. Hill diarrhœa and dysentery were dying out. Missourie especially benefited victims of malarial cachexia. Typhoid fever, he believed, was rarely met with. This was *par excellence* the health resort for children. Of late years much has been done as regards drainage, water-supply and general conservancy. The water-supply is from the rocks above, and its sources were well protected. It was distributed in galvanised pipes. There was a plentiful supply of good butchers' meat, vegetables, fruits, &c.

W. H. Gregg (Calcutta) said that, with regard to this subject, he desired to note the accompanying statement of vital statistics of Darjeeling, which have been accurately kept for some years past :—

Annual mortality from dysentery and diarrhœa in Darjeeling Municipality from years 1889 to 1893 :—

1889.	1890.	1891.	1892.	1893.
7·83	6·41	6·36	3·25	2·61

Since 1888, when considerable attention was drawn to the subject, great improvements have been made in the drains and general conservancy of the place. The consequence is that the death-rates, under the heading dysentery and diarrhœa, has steadily fallen from 7·8 to 2·61.

THE PASTEUR INSTITUTE AND VIVISECTION.

BY ROBERT HARVEY, M.D., F.R.C.P., D.S.O.,
Surgeon-Colonel, I. M. S.

GENTLEMEN,—The action of the Bengal Branch of the Anti-Vivisection Society in opposing the proposed Pasteur Institute for India has made it necessary that a reply should be made to their statements, since they have disturbed the minds of many sensitive and humane men, and made them hesitate as to whether they should subscribe to the Institute. I would, therefore, as Secretary to the Bengal branch, crave your indulgence while I sum up as briefly as possible the arguments for and against experiments on living animals, in the hope that I may convince doubters that they are not only justifiable but necessary, and that they may give their donations with a clear conscience.

I shall do my best to be frank and fair, and may say at starting that I have carefully read and considered all the anti-vivisection literature I could lay my hands on. I would begin by pleading for calm consideration of the matter, instead of the mutual recrimination which has been too common on both sides in this controversy. We want less heat and more charity. I have the highest respect for the feelings and motives of many of the opponents of vivisection, and do not think that science is in any way helped by branding them as faddists and fanatics, and I am equally sure that the more enthusiastic among them have done their own cause much harm by the exaggerated language in which they have denounced the eminent physicians and physiologists whose actions they object to.

The question may be looked at from two sides, ethical and scientific, and may be divided into two subdivisions :—

(a) Vivisection proper, which alone involves cutting operations on living animals.

(b) Experiments on living animals not involving cutting operations.

1.—Involving their death.

2.—Involving temporary pain or discomfort only.

The opponents of experimental research bracket all these together under the one head of vivisection, which is, of course, a misnomer; and they base their opposition on the following grounds:—

1.—That animals have rights as well as men; and that one of these rights is to be saved from cruelty.

2.—That the experiments lead to little or no useful or practical result.

3.—That even if they did, the cruelty which they involve makes them unjustifiable, since man has no moral right to inflict cruelty for his own advantage.

4.—That the experiments have a demoralising effect on those who perform them.

Some extreme partisans would add with Sir George Duckett (who declined to give evidence before the Royal Commission appointed in 1875 to enquire into the question, on the ground that he had no evidence to offer),

5.—That it is a *hellish* practice (the italics are the Baronet's) and "goes hand in hand with atheism."

The main arguments on the scientific side are:—

1.—That the experiments are necessary for the advancement of knowledge, and that this necessity is recognized almost without exception by the medical profession.

2.—That they have in fact, "been of inestimable service to man and to the lower animals, and that the continuation and extension of such investigations are essential to the progress of knowledge, the relief of suffering, and the saving of life."*

3.—That they are conducted under Parliamentary restriction without cruelty, and with the least possible suffering.

4.—That the statements of the anti-vivisection party are inaccurate, exaggerated, and misleading.

5.—That suffering and sacrifice are facts in nature which no declamation can eliminate, and that the rights of man are superior to those of animals.

6.—That the experiments have no demoralising effect on those who perform them.

We have here to do with questions of fact, with matter of opinion, and above all, with the meaning of words. Vivisection connotes the dissection of live animals without anæsthetics. The term should not be used—at least in my opinion—for experiments performed under chloroform, in which the animal is killed without recovering its senses, and which involve no pain. It does not apply to the killing of animals by poison or by snake bite, and still less to the feeding of them with particular varieties of food, inoculating them with disease germs, and so on, and though the anti-vivisection party objects to all these, they have no right to speak of them as examples of vivisection. Cruelty, too, is another word into which the objectors to experiments on animals have read an entirely new meaning not yet accepted by lexicographers, and much of the bitterness of the controversy has been due to confusion arising from this difference in meaning. What then is cruelty?

According to Webster, it is "an act which causes extreme suffering without good reason." "A *disposition* to give unnecessary pain." And this, the accepted English meaning of the word, is that adopted by the profession and by the physiologist. According to the anti-vivisectionist, as represented by Miss Power Cobbe, cruelty is "the voluntary infliction by a moral free agent on a sentient being of severe pain, not beneficent to the sufferer and not authorised by justice."* It is obvious that, according as we use the word in one sense or the other, both parties are right, for while the experimenters do not experiment without good reason and have no disposition to give unnecessary pain, the experiments are certainly not beneficent to the sufferers, although they are often of the utmost benefit to men and to animals as a whole. On the strength of this novel definition—entirely unknown to the English language—the anti-vivisectors denounce the experiments as atrocious cruelty, diabolical practices, hellish actions and so on, brand the experimenters as monsters, hold them up by name to the execration of mankind, send anonymous abuse to their wives, in short, forget the courtesies of controversy and the common decencies of life. When the human worm of an experimentalist, tortured by their calumnies, denounces their proved inaccuracies in plain Saxon, they complain that it is very rude to use such language to ladies and clergymen! It is greatly to be regretted that there is not better temper on both sides, and "the retort courteous" is always better than "the lie with circumstance." In a scientific discussion we want facts and arguments, not personalities. It seems to me that Miss Cobbe's definition begs the whole question, which is, Are the experiments cruel? The experimentalist, backed by the dictionaries, says, "No," because they are necessary and productive of great good to men and animals; the anti-vivisector throwing like Becky Sharp the "dixionary" out of window, and adopting a new meaning of his own, to say nothing of a new ethical standard, says emphatically "Yes." Miss Cobbe gives a clever classification of subjectively defined cruelty into ignorant, careless, wanton, malignant and interested cruelty. In "wanton cruelty the person causing pain for the sake of the emotional excitement which he devises from the spectacle," in "malignant cruelty the cruel person causing pain from hatred of his victim, and taking direct pleasure in his pain," in "interested cruelty, the cruel person causing pain with or without reluctance, for ulterior purposes of his own or the benefit of third parties," and she considers interested cruelty "the most dangerous." It is quite clear, then, that the assertions of atrocious cruelty so often made by the anti-vivisection party require to be received in a special sense, and that they apply the word cruelty to the experiments by a new standard which they do not use for the rest of the world. It is of the greatest importance, as we shall see presently, to keep this constantly in mind.

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* Resolution passed unanimously by the British Medical Association at Nottingham in 1892.

* The Modern Rack p. 62.

Having thus cleared the ground, we may now take in their order the main arguments of the objectors and the replies to them. And first as to the argument from the rights of animals. The physiologist and the physician are quite willing to accept the dictum that animals have rights, and that the right to be saved from cruelty is one of them. They maintain, however, that man has rights as well as animals, and that the rights of man are paramount over those of animals; that in the words of Scripture he has dominion over them, when good reason can be given for subordinating their rights to his. Next as to the argument from utility. It is a common contention that the experiments lead to little or no useful result, that they are confusing and misleading, hindering and not helping the advance of knowledge, and although her party make less use of this argument than they did formerly, Miss Cobbe's writings are full of it. Now, it is surely for the medical profession to say whether they have been helped in their efforts for the improvement of medical and surgical art by such experiments, and their testimony must outweigh that of women and clergymen not specially trained in physiological or surgical knowledge; and with very few exceptions the medical profession says it has been so helped. A resolution to this effect which I have already quoted was passed unanimously at a general meeting of the British Medical Association at Nottingham in 1892. A similar resolution was carried at the International Medical Congress in London in 1881. At the Church Congress at Folkstone in 1892, telegrams in favour of the experiments were read from several leading London physicians, one from that great and good physician, Sir Andrew Clark, declaring that he "regarded experimental research not as a mere privilege but as a moral duty." A Royal Commission appointed in 1875 at the instance of the objectors, and which included Lord Cardwell, Mr. W. E. Forster, Sir John Karslake, and Mr. Hutton of the *Spectator*, persons certainly having no prepossessions in favour of experiments on animals, joined in an unanimous report in which they say *totidem verbis*: "It would require a voluminous treatise to exhibit in a consecutive statement the benefits that medicine and surgery have derived from these discoveries." Their general conclusions were that it is impossible to stop experiments on living animals; that prevention even if possible would not be reasonable; that the greatest mitigations of human suffering have been in part derived from these experiments; that by the use of anæsthetics pain may in the great majority of cases be altogether prevented, and in the remaining cases greatly mitigated. They went on to say "that the abuse of the practice by inhuman or unskilful persons, in short the infliction on animals of any unnecessary pain, is justly abhorrent to the moral sense of your Majesty's subjects generally—*not least so of the distinguished physiologists and the most eminent surgeons and physicians*."* (The italics are mine.) We have here, then, ample professional evidence, and the opinion of distinguished laymen convinced by that evidence, as to the utility of the experiments.

Another point which they make is of practical interest to India, where the anti-vivisectionists wish to put an end to experiments for the discovery of an antidote to snake-poison. "It is not possible for us [they say] to recommend that the Indian Government should be prohibited from pursuing its endeavours to discover an antidote for snake bites, or that without such an effort your Majesty's Indian subjects should be left to perish in large numbers annually from the effect of such poisons."*

I may mention for the information of the general public that the discoveries of the circulation of the blood, the physiology of respiration, the functions of the spinal nerves, of the liver and thyroid gland, the localisation of the motor areas in the brain, the foundations, I may say of modern physiological knowledge, have all been founded on the Baconian principle, "Interrogate nature." All the experimental sciences are dependent on this, and without experiment no progress can be looked for. As Miss Cobbe truly says,† the experiments constitute "a method;" but it is precisely the same method as is essential to all the experimental sciences, and physiology dealing with life and vital phenomena experiments in that science must necessarily be on living creatures, since death puts an end to living functions. You may object to the method, but in doing so must recognize that you condemn physiology to stagnation, and with it put a stop to all progress in medicine and surgery, which are founded on a knowledge of physiology and pathology. By recent improvements many operations, formerly attended by a very high mortality, have been to a great extent freed from risk, while new ones, previously undreamt of, have been rendered possible. But for recent experiments on monkeys no surgeon could have accurately diagnosed the site of a tumour in the brain. The modern surgeon not only does so, but successfully removes it. By the sacrifice experimentally of a few sheep, pigs, and fowls, anthrax, swine fever, and chicken cholera have come under control, to the enormous benefit of the animals themselves, and the great profit of the farmer. It is stated,‡ I cannot of course vouch for the figures, that the mortality from anthrax has been reduced from 18 to 1 per cent., that some 3½ million sheep and 400,000 cattle have been inoculated against the disease in France alone, and that the money value of those saved is some seven millions of francs. This is another example of the utility of experiments, and we may say that their utility is now, however grudgingly, admitted by the anti-vivisectionists themselves. "Let us leave utility alone," says Miss Cobbe in a leaflet called "A Charity and a Controversy." "I do not say, and have never said, that vivisection is useless," says Lord Coleridge.§ Even Mr. Lawson Tait, the *Athanasius contra mundum* of the anti-vivisection cause, admits "That there is some good in vivisection"[*] though he considers it a rank discredit to the profession that we have to plead a necessity for it in any case.

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* Report, p xiv.

* Report, p. xiii.

† The Modern Rack, p. 55.

‡ Medical Reporter, 1890, p. 370.

§ The Lord Chief Justice of England on Vivisection, p. 7.

We come then to the main position of the anti-vivisectionists which I take to be:—That even if the utility were proved, the cruelty which the experiments involve makes them unjustifiable, since man has no moral right to inflict cruelty for his own advantage. If the latter part of this proposition is true it must be accepted as a development of what Miss Cobbe calls the "higher expediency" in ethics, a development in a progressive morality, and it must be true universally and always. You cannot limit a great moral principle, and say: Thus far shalt thou come and no further. If it applies to one set of men and actions, it must apply to all. You cannot divorce it from its logical conclusions. Miss Cobbe defines cruelty as the infliction of severe pain not beneficial to the sufferer, and she absolutely refuses to admit that it can be justified by utility. Let me quote herself: "If vivisectors have already made, or shall hereafter make, discoveries tending directly and importantly to relieve our bodily pains even *then* would vivisection, I ask, stand justified? Not so, my friends, assuredly.[†]" "If it appears that the practice be detrimental to the higher interests (she is speaking of moral interests) of the community, the question of whether it be useful to the lower (physical) interests scarcely deserves serious consideration."[‡] She is clearly committed to the statement, then, that the infliction of severe pain not beneficent to the sufferer cannot be justified on the plea of utility, and we have seen that this rule, if true at all, must be of universal application. It leads us by strict logical necessity to some strange conclusions. It might be held to forbid the killing of animals for food. It certainly forbids the killing of them in any but the least painful way, and would put an end at once to many practices now universally followed by man for his convenience, or sport, or profit (pecuniary or spiritual), the gratification of his personal vanity, or his bodily appetite. I will give specific instances presently, but the point I wish to insist on is that if for these purposes people other than physiologists inflict severe pain, not beneficial to the sufferers, on sentient beings, they are all, according to Miss Cobbe's showing, in the same boat with the physiologists, and deserve equally with them to be held accountable for the same crimes and denounced in the same terms. To use one set of terms for the physiologists, who at least profess that the sufferings which they cause, and which they would spare if they could, are for the benefit of both men and animals, and another entirely different set for other people causing sufferings as acute to an infinitely larger number of victims for their own pleasure and convenience, is distinctly unfair; and sufficiently accounts for and goes far to justify the hostility of the profession to the anti-vivisection party. Miss Cobbe "does not like sport herself, cannot conceive what pleasure her countrymen take in it," yet talks of "the joyous and open-hearted English gentlemen" who ride a fox to death, and will not suffer any one in her presence to compare the sportsman of the field with the sportsman of the laboratory."[*] Yet surely the fox-hunter inflicts severe pain not beneficent to the sufferer. She relates how, after her "conversion," she gave up fishing, but "freely admits that angling scarcely comes under the head of cruelty at all."[†] Surely the noble salmon fighting for its life suffers severe pain which is not beneficent to it. If, being a cold-blooded creature, it is supposed not to feel pain, why all the virtuous indignation over the "torturing" of frogs, which are probably less sensitive than fish, and which, moreover, are in the majority of instances rendered quite unconscious by pithing before the experiments are begun. For his convenience man constantly inflicts severe pain not beneficial to the sufferer. Take the mutilation of domestic animals. Castration is vivisection of the most painful kind, done without anæsthetics, which are required by law to be used in all scientific experiments not exempted by special license. Surely the operators in these cases deserve more opprobrium than the physiologists; and those who employ them or take advantage of their cruel acts, who drive geldings and eat capons, are participators in the crime. Yet Lord Coleridge justifies the practice as "a matter of sheer necessity," admitting for mere convenience the plea of necessity which he will not allow the physiologists. They also claim that it is a matter of "sheer necessity" that knowledge should be advanced, and efforts be made to discover the causes of disease and the remedies for it, for the far higher purpose of benefitting men and animals. Why should "sheer necessity" be allowed to the one and disallowed to the other? There are in all Europe, according to Miss Cobbe, 250 physiologists engaged in research work, but many of these seldom or never engage in vivisection experiments. For one animal subjected to the experiments of physiological research countless thousands are thus vivisected by castration, splaying, and caponising. Why do we hear of no demands for a bill to compel all these operations to be done under an anæsthetic? We venture to think because the anti-vivisectors know that the common sense of mankind is against them, and that they would have no chance of carrying it.

For pure sport man inflicts much severe and unnecessary pain. I have already spoken of hunting and fishing. The woes of the physiologist's rabbit are loudly proclaimed, but of the enormously larger number who are caught in traps and have to endure for hours the tortures of broken limbs, wrenched and mangled in vain efforts to escape, we hear little, and of the wriggling of the tortured worm impaled on the angler's hook nothing at all. The objectors to experimental research have apparently adapted the legal maxim into *de minimis non curat anti-vivisector*. I understand that Miss Cobbe allows us for our health's sake to kill vermin.

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[*] Lancet, 1892, Vol. II, p. 1302.

[†] The Modern Rack, p 59.

[‡] *Ibid*, p. 33.

[*] The Modern Rack, p. 23.

[†] Autobiography, p. 245.

Utility again! Has not a mosquito rights? Is a bug not a sentient being? Are their sufferings beneficent to them? For the sake of pecuniary profit—the basest of all motives—many cruelties are committed, but in this direction improved feelings of humanity are gradually interposing barriers, and many customs once common have now been suppressed and are punishable by law. Such were the skinning of animals alive to get the fur in better condition, the injection of air under the skin to increase the secretion of milk, and so on. For his spiritual profit man has never hesitated to sacrifice animals, and sometimes his brother man, to his gods; and while these bloody rites have disappeared from many modern religions they are still largely used in others. Thousands of goats and many cows are still sacrificed in India. Are their sufferings beneficial to them? They are purely for the good of man—real or imaginary—and every pious Hindu who has ever offered a goat to Kali should come under Miss Cobbe's anathema. The vagaries of fashion, the personal vanities of men and women are the cause of much pain. The wholesale clubbing to death of seals, the destruction of unoffending birds when fashion decrees that feathers are to be worn, the pain caused by gag-bits and bearing-reins are all examples. For the gratification of his appetite man does not hesitate to unsex fowls, subject innumerable geese to grave disease, boil lobsters alive, and do other acts quite as "cruel" as any done by the physiologist. In order that his veal may be white and more pleasing to his epicurean eye he allows the butcher to vivisect innocent calves by bleeding them to death by convulsions, and hang them up still living in his shop, as Lord Coleridge has seen.*

I think I have shown then that, according to the anti-vivisection definition of cruelty, all mankind are guilty as well as the vivisectors. There is but one exception, that I know of, I mean the Jains. They object altogether to the taking of life for any purpose, eat neither fish, flesh nor fowl, offer no sacrifices of blood, and carrying their principles to their logical conclusion like St. Aloys, " will not take the life of a flea." Of course two wrongs do not make a right, and if the experimenters are really guilty of gross cruelty, the fact that others are also guilty would not excuse them. The point I wish to emphasise is, however, that, according to the anti-vivisection definition, they are on all fours with the rest of mankind. Are we then to brand all men as torturers, careless of the sufferings they inflict? Assuredly not, and in the evolution of morals which is continually going on, the feeling against cruelty, and especially cruelty to animals, is constantly growing, and as the Royal Commission pointed out is felt not least by the men so ruthlessly denounced by the anti-vivisection party. These gentlemen do what all mankind are constantly doing: subordinate the interests of individual animals to the general welfare of humanity and of animals themselves, and they claim openly and honestly that their actions are altogether justified not only by necessity but by ethics. Justifying themselves they justify also all such actions of other men as do not involve wanton, unnecessary and objectless suffering. This they deprecate as much as the most sensitive of their opponents. They contend that such pain as they inflict is not "unnecessary" pain, not inflicted "without good reason," and that they are therefore not guilty of cruelty as defined by the dictionaries, and as understood by the world in general. They contend that putting their actions on a plane by themselves and applying to them a standard quite different to that applied to others is unfair, unjust, and illogical. If the pain they may have to inflict is necessary in the interests of knowledge or for the benefit of man or animals, its infliction ceases to be cruelty by the general consensus of mankind. Miss Cobbe will not admit this, unless the pain is beneficent to the sufferer. She expressly allows as not constituting cruelly corrective punishments, as when a father flogs his child to cure him of lying, surgical operations as when a dentist tortures his victim to relieve him of a still more torturing tooth, or a surgeon amputates a limb to save a life. By a curious mental process she brings into her exceptions to cruelty punishments authorized by justice. Her commonsense compels this. Yet how does it conform to her main premiss? It may be argued that most of the punishments awarded by the laws may have a correctional value and so be beneficent to the sufferers, but how about capital punishment? That is not and cannot be beneficent to the sufferer, however much it may benefit mankind by deterring others from like offences. It is " utility " pure and simple, and serves to show how unpractical and impracticable her definition of cruelty is, since it has to contain a clause going directly contrary to its own main principles. The ordinary definition is plain, logical and straightforward, and all men will agree that the infliction of pain without good reason, the *disposition* to inflict pain, constitutes cruelty, and that cruelty should be put down and punished. We acquit of cruelty all people who from ignorance or carelessness cause unnecessary pain, though those probably cause more suffering in the world than all the wilful cruelties ever committed. We " do not believe that the gentle ladies and refined gentlemen—to quote Lord Coleridge —who subject their horses to cruel pain day by day or year by year by means of gag-bits and bearing-reins, have ever seriously thought, or perhaps really know, what they are doing." " There is no cruelty as cruel as ignorance, " says Sir William Gull. The sheer ignorance of the mothers of India causes in this City of Calcutta the premature death of hundreds or thousands of children every year by most painful diseases. Yet I know no mothers who are more tenderly fond of their children. They are not *cruel*, they only do not understand. I need not dwell on the general cruelty of nature " red in tooth and claw with ravine." Nor on the cruelty of war. War is often necessary, but modern civilization has done much to mitigate its worst horrors. As practical men, we have to deal with facts as we find them. They are, as Burns says, " chiels that winna ding and canna be disputed."

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* The Lord Chief Justice of England on Vivisection, p. 13.

I may now go on to the supposed "demoralising" effect of the experiments on those who perform them. It is much insisted on in the writings of the anti-vivisection party, but is based on *à priori* assumption which even Miss Cobbe cannot admit as altogether valid. "Some of our anti-vivisection friends have a little misused the term 'demoralising.' They have supposed that a man who does things so cruel to animals must necessarily become thoroughly heartless, altogether inhuman towards men and women, base and brutal in every sense . . . But there is some mistake here.*" Of course there is; and the statement of some of our anti-vivisection friends is as little consonant to a knowledge of human nature as to charity. There are no keener fishermen than the clergy. Yet the contemplative man's recreation involves the grossest treachery, the most deliberate deceit, to say nothing whatever of its cruelty. We do not find, however, the clergy demoralised or converted into monsters "base and brutal in every sense," and I know no more genuinely pious book than the work of that quaint old cruel coxcomb, Isaac Walton. I am proud to number among my friends several of the gentlemen who are labelled "vivisectionists" in Miss Cobbe's Index, and know them to be humane and honourable men. The profession recognizes this and honours them, and while many of us, including myself, never have done or witnessed an experiment in vivisection, we recognise the help that these men have given us, and stand shoulder to shoulder to vindicate them and their work. I am not constrained to deny, I will freely admit, that many cruelties have been performed by experimenters. Cruel men may exist in the medical profession as elsewhere, and should be dealt with in the same way. In ancient days, too, "harder the times were," and I have already pointed out that many forms of cruelty formerly common are now suppressed by law and public opinion. Many of the specific instances cited in the book called the Nine Circles are of this nature, and would no longer be tolerated. At page 95 for instance is a case dating from 1755. Yet they are constantly alluded to as if they were occurrences of to-day. I contend, however, that under present restrictions, the rights of animals are as well safeguarded as it is possible to make them. By "The cruelty to Animals" Act, 1876, 39 and 40 Victoria, C. 77, passed with the assent and consent of the medical profession in England, all experiments are regulated. Its chief provisions are as follows:—Painful experiments on animals are prohibited, under heavy penalties, except subject to the restrictions imposed by the Act. The restrictions are that the experiment must, in every case, be for medical or physiological purposes; that the operator must be licensed under the Act; that the animal must be under an anæsthetic and must be killed before it recovers therefrom if it be seriously injured, or the pain be likely to continue; and that the experiment must not be performed as an illustration of a public lecture, or for the purpose of obtaining manual skill. Most of these restrictions may, however, be relaxed on a certificate being obtained, in manner provided by the Act, setting forth valid reasons for such relaxation. There are also special restrictions as to the performance of painful experiments on horses, asses, mules, dogs and cats. No public exhibition of painful experiments may be given or advertised. Persons aiding or performing such experiments illegally are subject to penalties. Licenses are granted by the Secretary of State, who has powers to compel the registry of places in which such experiments are to be performed, to cause such places to be visited by inspectors, and to direct any person making such experiments to report the results to him. Application for licenses must be signed by one or more of the presidents of certain medical, surgical, and scientific bodies specified in the Act, and countersigned by a university professor of physiology, medicine, anatomy, medical jurisprudence, materia medica, or surgery, not being the applicant himself. A judge has power to license such experiments when he deems them essential for the purposes of justice in a criminal case. No prosecution under the Act can be instituted against a licensed person without the assent in writing of the Secretary of State. The Act does not apply to invertebrate animals. It is a mistake to suppose that licenses are easy to obtain, and exemptions from restrictions are not given without cause shown. The vast majority of the experiments performed under the Act involve no vivisection, a large number involve little or no pain, less pain for example than that to which so many of us have cheerfully submitted from my friend Professor Haffkine. This is one proof that the statements of the opponents of the Act are exaggerated and misleading. To judge by their writings it might be supposed that the torture of animals was the daily pastime of the medical profession.

I have waded through a mass of their literature for the purpose of this paper, and the perusal makes me understand as never before how the agitation is manufactured and maintained. It also enables me to sympathize with the movement to some extent. I hate cruelty as much as most people, and I can understand the indignation excited in imaginative and tender minds by reading the bold, blank horrors of the anti-vivisection books. These say little or nothing of the object of the experiments; the use of anæsthetics is either not mentioned or brushed aside as not really abolishing pain, the results are sneered at as useless, symptoms occurring in insensible animals are accepted without question as evidence of acute agony, and so on. The writer's imagination riots in harrowing descriptions, and ladies ignorant of physiology, ignorant of science, ignorant of all but of goodness and kindness, "whose soft blue eyes are tender over drowning flies" believe it all, and are horrified accordingly. Who shall blame them? The very writers themselves are to some extent self-deceived. They have at least by a long contemplation of one set of facts (or fancies) got to attach an importance to those out of all proportion to their intrinsic weight. They shriek, as we have seen, over the "agonies" of the frog, while justifying the torture of the suffering salmon; eat their veal and *foie gras* contentedly, and bemoan the woes of the rabbit used for the advancement of learning, while ignoring the thousands of these same rabbits killed in gins and snares. That many of their statements are exaggerated and distorted can be proved up to the hilt. In the first edition of the anti-vivisectionist bible "The nine circles," it is stated by Miss Power Cobbe that whenever anæsthetics were used the fact is mentioned in the text. Professor Horseley showed that out of the 26 experiments involving cutting operations recorded in the book, as performed by English scientists, and in all of which anæsthetics were used, the fact was not mentioned at all in twenty, and only stated without qualification in two of the remaining six. At page 247 of her autobiography she states that the Society for the Prevention of Cruelty to Animals laudably exerted itself to stop certain cruelties in France, and appealed to the Emperor to interfere, not perhaps very hopefully, since, as she had heard, Napoleon III was in the habit of attending these hideous spectacles in his own imperial person. "She had heard." My honourable and learned friend who heads the anti-vivisection movement in Bengal will tell you that "I have heard" is not evidence. Surely, gentlemen, recklessness of accusation can go no further. To deliberately assert that a fact has been mentioned in every case when it is omitted in 20 out of 26, to level an accusation of the most monstrous kind against a man on the strength of "I have heard," quite passes, it seems to me, all fair controversial limits, and cannot be excused on the ground that the narrator was misled. Good faith ceases to be such unless reasonable pains are taken to ensure accuracy. As Professor Horsley rightly said at Folkstone: "No man, be he bishop or layman, has the right to publish defamatory statements against a man or a body of men without having taken the pains amply to substantiate his position." I have the greatest possible respect for Miss Cobbe, much as I dislike her "methods." I have no doubt she believed in all good faith what she was saying. She was grossly misled, as she has frankly acknowledged. No great cause was ever gained without enthusiasm, but legitimate enthusiasm must restrain itself to facts. Now, it is untrue and exaggerated statements of this kind which form the basis on which most of the anti-vivisectionists rest their opposition. The exposure of their inaccuracies, however, though sufficient for thoughtful men, has little effect on the *idcé fixè* of the anti-vivisectionists. The untrue statements are put aside as regrettable mistakes of no consequence, mere side issues which do not effect the main principle, and the flood of garbled exaggerated misapprehended accounts of cruelty goes steadily on, producing its natural effect on ignorant people who know nothing of the real merits of the case. The party has become quite irreconcilable, and not content with opposing vivisection properly so-called, now appear to "go it blind," as the Americans say, against all experiments for scientific purpose. They are specially severe on those in which disease is imparted to animals for the purpose of studying its pathology and discovering remedies for it. But medicine is a progressive science; we are all striving to improve it, and as we have seen improvement is impossible without interrogation of Nature, *i.e.*, without experiments. If experiments on animals carefully directed to a given point for a special purpose are not allowed, we have to experiment in a clumsy, incomplete, and indecisive manner upon man himself. We must remember that it was by experiments mainly of this nature that the discoveries which have been so fruitful to animals themselves were made, and that anthrax, swine fever, chicken cholera, have been robbed of their terrors, and that the chief hope and promise of future advance lies in their continuance. Yet all, painless and painful alike, are objected to by the anti-vivisection irreconcilables on the ground that "no line can be drawn between experiments *per se* almost harmless and those which involve gross cruelty," and that "if it be found impossible to separate the use of a thing from the abuse, and that abuse amount to a great moral offence, then it becomes needful to prohibit the use."* This is a mere *petitio principii.* It assumes that it has been found impossible to avoid abuse. This the profession denies, and I trust I have proved to you rightly denies.

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* Modern Rack, p. 34.

I mentioned among the objections the opinion of a gentleman who, knowing nothing on the subject, denounced the experiments as hellish practices going hand in hand with atheism. It would not be worth while noticing this, but that in many other instances the same feeling is expressed in less crude terms. The opponents of the experiments are largely ladies and clergymen of a particular cast of religious mind, and a good deal of the agitation seems to be directed against science as opposed to religion. "Science falsely so-called," they are fond of calling it in the words of St Paul. But science is knowledge, the pursuit of truth is her end, and truth cannot be hostile to truth. She is in no sense hostile to religion, though she may occasionally come into collision with particular errors commonly held to be part of religion, but not really so, such as the doctrine that the sun went round the world, the world was created in six days, and so on. Still there is undoubtedly an opinion in the so-called religious world that scientific men are hostile to religion, materialists, agnostics, atheists† and what not; and this is constantly cropping up in the anti-vivisection literature. The experimenters are solemnly warned by texts and otherwise as to the fate probably in store for them hereafter. It is strange that it was these same people or others of a like kind who, when medical science invented a means of alleviating the "tortures" of child-birth, denounced the invention as an impious attempt to save women from the punishment rightly inflicted on them by an offended deity. It is they who, on the highest moral grounds, have been the indirect means of extending to an incredible extent those venereal diseases which are sapping the strength of our armies, and involving untold suffering to a large number of innocent women and unborn children, utterly regardless of consequences, so long as vice is not recognised by the State. They plead, of course, that they are not accountable for the effects of the wrong actions of others, but it seems to me that when it is known that certain preventable effects are certain to arise, those who prevent others from preventing them are morally responsible for the consequences. The ravages of syphilis cause, I have no hesitation in saying it, more misery and suffering than all the experiments on animals put together, yet medical men who wish to prevent the one are denounced almost as loudly as those who perpetrate the other. The position of the party—for it is practically the same party—on the two questions is I maintain hardly consistent, however it may accord with their idea of high morality. Texts are double-edged weapons, and if it may be done without irreverence the experimenters may remind their opponents that the Christ to whom Lord Coleridge appeals in his concluding sentence is He who said: "Ye are of more value than many sparrows," and thought it right, as most anti-vivisectors believe, to sacrifice a whole herd of swine to relieve one possessed with a devil.

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* The Modern Rack, p. 54.

† "The contemplative atheist is rare, and yet they seem to be more than they are, because all they that condemn a received religion or superstition are by the adverse part branded with the name of atheists."—*Bacon.*

It seems to me from a careful perusal of the anti-vivisection literature that the bulk of the opposition to experiments is founded on ignorance, on taking for granted as truth, untrue or grossly exaggerated statements, on a recital of old horrors, the repetition of which is impossible to-day, at least in England, on a misuse of plain English words, and the treatment of physiologists as a race apart, to be tried by quite other standards than the rest of mankind. It is only by lightening the darkness of ignorance that we can hope to overcome the opposition. Much of it is sentimental, much unreal, and while I believe that there are many anti-vivisectors who, if bitten themselves by a rabid animal, would carry their conviction to a logical conclusion and die of hydrophobia rather than resort to Pasteur—there are many who would not—and I think there are few of those most strongly opposed to it, who would not if the case was in one near and dear to them, be ready to say: "Oh bother consistency! What are twenty rabbits to the life of our child." A good example of this was given by Professor Horseley at Folkstone. The Duke of Newcastle was Vice-President of an Anti-vivisection Society. His brother was bitten by a dog. The dog was killed, and the Duke took its body to Professor Horsley at the Brown Institution. He was told that the question whether the animal was mad could only be settled by inoculation experiments. The Duke assented, and frequent inquiries were made by a member of the family to ascertain the results. Another good illustration of the illogical position of the anti-vivisection party was given at Folkstone by Bishop Moorhouse, who is reported to have said that he would "abstain from animal food if any one would show him how he could live without it and keep his voice." Here is the barest "utility," a great principle sacrificed to a personal end. Yet, while the throat of the clergy is sacred, the throats of the thousands who perish annually of diphtheria are to go unrelieved, to save a few horses from an operation which does them no harm and causes but trifling pain. In my presidential address you may remember I pointed out how the new treatment for diphtheria could not be utilized in India for want of a Pasteur Institute. Even as I spoke a terrible illustration of my remarks was in progress, and one of the best and noblest and most enlightened of Indian Princes was going to his death from a disease which, when taken early, is probably almost always amenable to the new method of treatment. H. H. the Maharajah of Mysore has just died of diphtheria, and the conventional "all that could be done was done" by the most skilled medical attendance, is true in a limited sense only, since if Behring's Antitoxin had been available, his most valuable life might have been spared.

I hope, gentlemen, I have said enough to convince the outside public that scientific research is necessary to the advancement of knowledge, and in the interests of both men and animals; that it involves no cruelty, properly so-called, and very much less pain and suffering than many other things sanctioned by reason and by the universal custom of mankind; that it is safe-guarded from abuse by sufficient legal restrictions, and that sensitive and humane men may lend it their moral and material support with the clearest of consciences. When mankind has been converted to Miss Cobbe's new definition of cruelty, when all have become vegetarian, no longer think it right to follow the sports of the field, to defend themselves from the assaults of their enemies, or to subject the lower animals to pain or inconvenience for the sake of human wants, necessities, and convenience, the labour of the physiologist will doubtless come to an end. Till then we must ask an equal freedom with the rest of mankind, and it may be doubted if such a world would be an inviting dwelling-place. I respect their motives and have tried to be just to those who differ from us. I would they would return the compliment, and believe that we also are honourable men, striving for what we believe to be legitimate and necessary ends.

I need not tell you, gentlemen, that a branch of the Pasteur Institute is necessary to India not only in the interests of those bitten by rabid animals or infected with diphtheria, but for the investigation of the Indian diseases of men, animals and plants. I want you, however, to help to convince the public that this is so, by unanimously affirming this in a resolution as follows: "That a Pasteur Institute for India is essential to the advancement of science, the investigation of Indian diseases in men, animals and plants, and the treatment of diphtheria, as well as of those bitten by rabid animals."

Mr. Hankin (Agra), in seconding the motion, said:—"I have great pleasure in seconding this motion. It is impossible for me to add anything to the able and lucid address of Surgeon-Colonel Harvey that we have all listened to with so much pleasure, at any rate from the argumentative standpoint. I should, however, like to say a word from the standpoint of one who has carried out vivisections. During the few years before leaving England, I possessed a license under which I carried out a large number of operations of this nature, perhaps a larger number than were done by any one else at the time in England. In the whole series of vivisections I do not believe I ever gave an animal more trouble or pain than is often given to a child by vaccinating it. I remember discussing with my friends whether killing a rabbit by chopping off its head at a single blow was "vivisection," or whether taking a minute drop of blood from its ear was of this nature. But though, in the second case, at least if the animal was tame the discomfort was so trivial that it did not interfere with its feeding, we had to decide that it came within the letter of the law, and such operations had to be returned as "vivisections." It is noteworthy that such trivial operations are of the kind most prized by these unscrupulous anti-vivisectionist agitators, as they are of the kind done without the aid of anæsthetics. They actually did go round the country parading such experiments as examples of the horrible sufferings inflicted on animals by physiologists. By the use of such tactics the anti-vivisectionist party at home has become thoroughly discredited, and I should be sorry if anyone in India should think it necessary to give much attention to anything they say. I have much pleasure in seconding the motion. (Applause.)

The resolution was carried unanimously.

SECTION

OF

MILITARY MEDICINE & SURGERY.

THE AMBULANCE IN WAR:

Its Rise and Progress amongst Civilized Nations.

BY ALBERT A. GORE,
Surgeon-Colonel, A. M. S,
President of the Section.

For many centuries systematic arrangements for the care of the injured in battle were conspicuous only by their absence. Not until the Christian era was well advanced did the surgeon become a recognised feature in the military establishment. Several hundred years had still to elapse before the introduction of field hospitals, and it was not until the present century that organised methods of relieving the injured in the field, collecting them into hospitals, and nursing them to health were established, and the recognition of the fact that a disabled soldier is eliminated from the fighting strength of the enemy, and may be considered neutral, has had an existence of but a quarter of a century.

To Baron Percy, a leading surgeon in the armies of Napoleon, the world owes an incalculable debt for the conception and first organization of a prompt aid to the injured. Tired of the ceaseless disorder of undisciplined hospital attendants, distressed at seeing the deaths on the field of battle of so great a number of soldiers, whose lives might have been preserved and limbs saved if they had had the help of a commodious and well-organized means of transport, having seen, moreover, the necessity of having, as near as possible to the line of battle, men especially trained and designed to carry off the wounded, instead of leaving them to the care of soldiers of the fighting line, who, in assisting their comrades, got from under fire in large numbers, he, with the permission of the Emperor, selected a company from among the bravest and most adroit of the army. These he equipped for the work of promptly removing the wounded and put them on duty. The immediate consequence was an entire rehabilitation of the service of the sick and wounded, which, neglected and abandoned before, became at once efficient and satisfactory. Following Percy, Baron Larrey, Surgeon-in-chief of the French armies during their brilliant campaigns, organized his "Ambulance Volante," and in our own army, Sir James McGregor, principal medical officer to Lord Wellington in the Peninsula, introduced many improvements with especial reference to more mobile equipment for rapid movements, and arrangements for the dissemination of the sick. Nevertheless, another half-century was allowed to elapse before the system became general throughout the armies of Europe, but as early as the campaigns of 1813-14 the Prussians had seen the advantage of scattering their sick and wounded as much as possible to avoid the deadly contagion and excessive mortality of crowded hospitals.

Sir Henry Holland, the eminent physician, in his "Recollections of a Past Life," has left a graphic picture of what he saw of our sick and wounded in Spain after the great battle of Vittoria about this period, and remarks: "No spectacle is more painful than that of the carriage of the wounded, the sick, and the dying in the midst of a campaign. It is the blackest page of war. The triumphs of the battle field are all dimmed in looking at this inevitable sequel. It is needful to have seen it to comprehend it, for official despatches and history tell but little of the reality."

During the periods which have elapsed since the wars of the early part of the century, the functions of the ambulance soldier have been extended far beyond that required by Baron Percy. He is now not only required to remove the injured from the field, but to apply such immediate treatment as, until the arrival of the surgeons, may ward off death, and procure temporary relief from suffering. The medical officer finds this part of the work of well-trained ambulance assistant of incalculable advantage.

The work of the modern hospital corps extends still beyond the first aid to the injured. The transfer of the disabled and the care of the wounded in field hospitals and the large permanent hospitals are also in his hands. Such varied duties require, not only care and skill, but more than ordinary intelligent and courageous men, equally indifferent to the perils of battle, the hardships of campaigns, or the contagion of the infectious wards; and require for their administration a prolonged study and a varied practical experience.

The Red Cross Societies, whose branches now extend throughout the world, have also done much towards ameliorating the sufferings of the wounded in war, and the soldier owes much to the tender care bestowed upon him by the nursing sisterhoods. In every country a new field of honour has sprung into existence. The necessity of having some means immediately at hand to facilitate the early treatment of the wounded soldier has been long recognized by the Prussian Government. In the Bavarian war of 1778, the Prussian soldiers had given to them a tourniquet and a bandage of eight ells long, and in their Field Hospital Regulations of 1787 it was ordered that on the outbreak of war each soldier was to receive from the regimental surgeon a quarter pound of charpie and two bandages. This last is the earliest record of a first field dressing. Sixty-eight years elapsed, and in 1855 Prussia established "Bearer Companies" for the especial object of affording aid to the wounded, and transferring them from the field. Each army corps was allowed one of the companies, numbering two hundred and two non-commissioned officers and men, with forty-five hand litters and twelve pairs of crutches. The company was divided into three sections, one with each division of the corps. These were attached to the flying detachments of the three light hospitals. This "flying detachment" accompanied the troops into the field, and rendered first aid to the wounded; but in order to prevent accumulation and consequent delay, the aid given was restricted to the application of the first bandages, the administration of restorative, and the performance only of such operations as were necessary to preserve life. A sheltered position (the bandage place), being selected as near as possible to the troops engaged, was distinguished by a flag. Here five medical officers, an apothecary, and ten sick attendants with bottles of water assembled; four ambulance wagons for severely wounded, a medicine and bandage wagon, and the reserve wagon were stationed close at hand. The remainder of the personnel and material, etc., joined the depôt established in a village or farm buildings a little in the rear, and beyond the zone of cannon shot. Here further attention was given to the wounded, and they were either transported to the heavy corps hospitals further to the rear, or to the means of transit to the fixed hospitals at the base of operations. The regimental medical officers occupied positions close to the rear of the troops engaged, and, attended by a portion of the hospital attendants with medicines and surgical appliances, made the first examination of the wounded, rendered some immediate assistance, appended a certificate stating very briefly the nature of the injury and assistance rendered, directed their transport to the field hospital, and so facilitated the classification and removal of the wounded. The presence of these companies prevented men from the actual fighting-line leaving the ranks for the purpose of carrying their wounded comrades to the rear; they protected the wounded on the ground from thieves and marauders, and in long marches supplied water and refreshment to men who fell out. The men were carefully selected from the reserve and first corps of the Landwehr. In the efficient performance of their duties they were carefully trained, were instructed by the medical officers in a few points of anatomy and practical surgery, in the application of the tourniquet, and other means of arresting hæmorrhage, the readiest means of restoring suspended respiration, how to handle fractured limbs and bandage wounds, and in the safest means in lifting men from the ground, and the easiest position for them to lie upon the litter; each carried a knapsack and water bottle.

Three other classes of hospital attendants were carefully trained in the Prussian army after one year under arms in the ranks, and who, if they showed any aptitude for hospital duties, and volunteered to join, were excused the further period of legal service. 1.—Hospital assistants (Lazarette-Gehulfen) of superior educational qualifications and inclination for hospital work, who carried on the march a few instruments, bandages, and restoratives necessary for an emergency. One to each company, squadron, or battery of artillery. 2.—Wardmasters selected from the above and in charge of the bedding, furniture, and utensils of an hospital. 3.—The sick attendants.

All the foregoing were trained by the medical officers in the garrison hospitals. Female cooks and washers, with assistants according to the number of sick, were attached to each hospital. The wagons of the light field hospital carried equipment for two hundred and fifty wounded and rations for two hundred sick and wounded for three days. The tent for operations and the litters were carried on the ambulance wagons. The diets were the same as in garrison, supplemented by medical comforts. In the French army at the epoch of the Crimea very complete instructions existed for the war service of army hospitals. The "ambulance" was sub-divided into the "flying" and "ordinary." The first was composed of a light cart placed at the vanguard with two surgeons, one officer of administration, and two "infirmiers" to bring succour wherever it was wanted. If the nature of the ground prevented the light cart approaching, two of the dressing baskets were removed from the cart and loaded upon one of the horses of the team. The ordinary "ambulance" consisted of five carriages. The first having material for 1,400 dressings, etc., could be used as a light or flying ambulance wherever a carriage could have access. The others contained material of different kinds, packed in baskets. An "ambulance" was attached to each division of the army, always in motion with it, and could be subdivided in case of need into six parts.

At the commencement of the Crimean campaign our army departmental organization was very defective. Forty years of peace had dissipated the experience of the Peninsula. "It apparently" (writes Sir Evelyn Wood, the present Quarter-Master General, in his interesting reminiscences of that period) "was not contemplated in those days that soldiers could get ill, for the battalions arrived at Gallipoli on 15th April, when the thermometer was 28° at night, without hospital equipment, and the sick had no mattress and but one blanket. The medical officers were of a high social class. Many had entered the service with excellent professional qualifications, but in their ordinary duties two had merely the care of twenty or thirty men with simple complaints. A different department held and issued drugs, and from the replies the most ardent medical officers received to requisitions, it had come to be understood that a medical officer was valued in inverse ratio to his demands for medicines and medical comforts. The system was bound to break down in war, and thus prove disastrous for the men, as it was prejudicial to the medical officers, who had neither adequate opportunity of utilising their technical knowledge, nor of practising the administration of their department." On the 14th September 1854, 20,000 British troops were landed from the fleet with only two ambulances without horses, and these went quickly to pieces. The officers and men landed for the last time in full dress with three days' salt pork and biscuit, but the rank and file so weakened from intestinal complaints that they were thought to be incapable of carrying their knapsacks. Cholera followed them across the Euxine and from the steady downpour of rain, culminating in torrents at daybreak, the only protection was a great coat and blanket. Nevertheless with that pluck and endurance which has always been the characteristic of the three nations composing the army of Great Britain, they fought and gained a brilliant victory in the style of the old army of which they were destined to be the last representatives, for before the end of January 13,000 of these brave men left invalided for the Bosphorus, of whom 976 died during the short passage of thirty-six hours. "It is consoling" (writes Sir Evelyn Wood) "to reflect that all this misery was not in vain; and in recent expeditions, for instance in that up the Nile, our great base hospital at Wady Halfa, several hundred miles beyond Cairo, was supplied with ice for serious cases and hospital ships with ample medical and record staffs, alleviating the sufferings of our wounded soldiers abroad and the mental anguish of their families at home." He might have added that the field hospitals fully equipped were in this campaign pushed forward to within no great distance to Berber.

The experiences of the war in Italy in 1859 gave a great impetus to ambulance work. The French adopted the plan of distributing the sick and wounded in a great number of comparatively small hospitals. Typhus was thus avoided, and there was comparatively little purulent infection. In the Austrian hospitals, on the other hand, after Magenta, the daily growth of sick was 600 to 800, and soon 8,000 men were crowded into hospitals intended for only 4,000. In Verona and other fortified places, with narrow spaces and vitiated air, hospital gangrene and typhus appeared to the great danger of the sick as well as the effective garrison. The police conservancy was bad, and the heat excessive; 1,200 sick and wounded had to traverse daily the main road to Nubra-Sima, as the railway could not be utilized. The bad country carts broke down, the cattle fell sick, and their transport became more difficult. At Palma Nuova 1,300 men, almost all wounded, had no shelter; nothing had been prepared for them, and only two surgeons were available for this mass of patients with a want of material of all kinds. Public sympathy was aroused. Several improvised hospitals were opened. The Empress presided over one at Lazenburgh. Ladies of the highest rank attended and administered in the hospitals with an extraordinary zeal, and aid societies everywhere arose which forwarded stores, food, and money. In these campaigns it was proved by experience that the telegraph was of the most essential service in rendering the distribution of the sick possible which now took place over a large extent of country. Epidemics amongst them were at once arrested. No less than 48,713 sick were sent out of Italy, *viz.*, 11,300 into civil hospitals or private dwellings, and 23,040 into military hospitals in the provinces. The mortality in the latter was now very small—2·5 per cent.—while at the seat of war it averaged 8·5 per cent. In the 4,086 surgical cases received into the hospitals at Brussels after Waterloo, it was 15·6, 26 per 1,000 being from hospital gangrene.

The result of this distribution of the sick and wounded of the army was most marked. It produced an excellent moral effect, and both the executive and medical officers were convinced of its utility. But it was pointed out that, in future wars, the system should be much more carefully prepared for; that it should be commenced at once and not left to the moment of pressure; and that by means of properly arranged appliances, or railways and water carriages, the army in the field could be left with merely its necessary field hospitals, and the terrible pressure caused by a large assemblage of sick and wounded avoided. The experience of the war, both on the Austrian and French side, also clearly showed that the sick and wounded were not injured by judicious transport, but were often benefited by the change and the abundance of fresh air, instead of being exposed to the fatal atmosphere of a crowded hospital. This was an old Peninsula experience, and Sir Randolph Routh, who served there under Lord Wellington as Commissary General, has left on record the following note: "The good management of the hospitals is a service of great importance, a comfort and encouragement to the army, and a means of recruiting their ranks with tried and experienced men. It is essential, therefore, that their wants should be foreseen and anticipated, and a proper system explained and established to provide for their supply, and for the conveyance of the sick and wounded and of the depôts of all kinds collected for their use, and that all these preparations should be at hand." Quickly following upon these military operations which had shed such a lustre on the French arms the civil war in America gave a further opportunity of observing the working of the ambulance in war. Already, in December 1860, two hundred regiments were on the Potomac, 176,042 men, 7·3 per cent., or 12,841 had to be provided with hospital shelter. Diarrhœa and digestive derangements from altered diets being the most common ailments. It was proved by experience that the soldiers had not the least idea of cooking, an old experience also in our armies. Lord Wolseley has lately written in addition: "I do not think that any writer upon our operations before Sebastopol has dwelt sufficiently upon the extent to which our difficulties were attributable to want of fuel for cooking purposes. It was seldom that our men had their meat thoroughly well cooked, and upon many occasions men ate it raw. If I was asked to single out one amongst the many causes to which our collapse in the Crimea should be especially attributed, I would answer the want of firewood to cook with."

The army ration was at once improved and increased, and by a special Act of Congress the sale of ardent spirit to the troops was prohibited and permission was given to substitute a ration of tea or coffee, if desired. In the beginning of 1861, the old medical organization of the United States army had become so manifestly inadequate that a bill was introduced into Congress by Senator Wilson and an improvement and thorough reform instituted.

In twenty-eight months from the commencement of the war, 1,200 volunteer surgeons went into the field. Yet, in spite of the great number of medical officers, complaints were made that they were not enough, and it is said that the horrors of the battlefields of Bulls' Run, Fort Donaldson, Pittsburgh Landing, and Williamsburgh can never be written. In November 1862, there were one hundred and fifty general hospitals in the North, containing 60,500 sick, upon whom were attending 400 stewards, 300 wardmasters, 6,051 male and female nurses, 3,025 laundresses, 2,017 cooks, a total of 11,343, from which figures may be gauged the labours of the hospital staff and their subordinates. After the battle of Antietam the number of sick and wounded in all the divisions of the army was 90,000. An "Ambulance Volante" had to be quickly instituted. Flying hospitals, consisting of mule corps, cacolets and panniers, containing hospital supplies of all kinds to accompany rapid expeditions, were organized by Dr. Hamlin in General Siegel's army, and were found to be highly useful. Upon the urgent representation of the Surgeon-General as to its necessity, an ambulance system for the Potomac was organized by General MacClellan in 1862, and placed under the orders of the Medical Director, General Meade, who succeeded General MacClellan in the command, extended and completed the ambulance of the Federal Army. For each division the personnel was: 3 officers, 15 sergeants, 135 men, 45 ambulances. One light medicine wagon and one four-horse supply-wagon were in addition allowed to each brigade, and the ambulance encamped by divisions. When a movement was ordered the sick were taken by the train of their respective divisions, the regimental hospital wagons were ordered to join, and the hospital appliances of each division followed in one compact column. Upon the train halting, hospitals were established rapidly, and the nursing aid rendered by the ambulance corps. In these hospitals all the remaining medical officers of the division assisted, except one to each regiment. Although not less than 5,000 medical officers were employed with the active army, they were found to be numerically incapable of dealing with any great emergency, and hundreds of wounded after Gettysburg had to remain unattended to for days. In consequence of this a "Reserve Medical Corps" of thirty surgeons to each State had to be formed, who, when called upon for service, were to remain at least fifteen days with the army. In July 1863, more than 100,000 men had been permanently invalided from the army. As the result of experience in this war the "Pavilion" system of hospital construction was invariably adopted. It was advised that all temporary hospitals built in time of war should be made of wood, one storied, with ridge ventilation, each for fifty men—cubic space for each 950. The largest hospital erected in the Northern States, in fifty separate pavilions radiating from a centre, contained 2,820 beds for patients, and 500 for attendants, in all 3,320. The Philadelphia Railway passed close to it, and patients from the army of the Potomac were brought to the door without leaving the cars. There were 30 medical officers, 8 stewards, 3 chaplains, 495 cooks, nurses and other attendants.

In the field hospitals of the northern troops tents, fifteen feet square, to contain six men, eight at a maximum, warmed by a small camp stove, and provided with a fly, were considered to form the best hospitals; two or three could be joined together. These tents were floored, as a rule, if not they were struck and moved once a fortnight. They were placed in echelon. In the Confederate Army an ambulance corps had been early formed from a given number of suitable men from each brigade, who, when approved by the medical officers, were trained into a permanent ambulance and field hospital corps, which did admirable service.

In future military operations in America, the care of the sick and wounded will be in the hands of a sanitary corps, consisting of medical officers, company bearers, non-commissioned officers and privates of the hospital corps.

During this great civil war the American nation, without the voluntary aid from peoples of Neutral States proved itself fully capable of performing its duty to its wounded in the most zealous and efficient manner, and the Sanitary Commission of the United States stands out among the noblest works in the world's record of devotion. Well might its historian write of it as "the true glory of our age and our country: one of the most striking monuments of its civilization."

As a result of their many expeditions in Algeria the French had organised, by 1865, a very good light field hospital or mule ambulance. The number of mules or cacolets for carrying sick and wounded depended on circumstance. For a column of one thousand men was allowed one sergeant, one corporal, eighteen hospital attendants as a nucleus, with a field hospital packed and ready to move, eleven mules, with attendants and eighteen mules for cacolets. When small numbers of men were detached against an enemy in Algeria, a couple of mules with cacolets, and a medical and surgical knapsack, containing a set of capital instruments, besides medical and surgical requisites, carried by an hospital attendant, were deemed sufficient.

The "Bearer Companies" introduced into the Prussian army were, during the campaign in Bohemia in 1866, put to a severe test. All officers united in praising their work, and so important were their services considered that during the war each battalion of infantry was called upon to furnish at the commencement of an engagement twenty men with a non-commissioned officer as auxiliary bearers, and to increase the efficiency in future a permanent addition of two hundred men with a proportionate number of litters, were added to the company attached to an army corps. During the war tents were not necessarily supplied to the field hospitals, and marquees were only provided from the train depôts when villages and buildings near were not available. The experience of the war was, that all hospital equipages should be in any future campaign sufficiently light and mobile to enable them to accompany the rapid movements of modern armies, each section to be complete in itself, and available for any emergency that might arise; that the weight carried by a soldier should be reduced to a minimum; that efficiency was best obtained by giving a dress and equipment suited to the work to be done, doing away with all useless encumbrances, and husbanding the men's strength until the moment of action.

The Report of a Board of Officers assembled in Berlin on the conclusion of hostilities recommended that the distinction between light and heavy field hospitals, 200 and 600 beds respectively, should be abolished. That every army corps of 30,000 combatants should have twelve light hospitals, each capable of accommodating two hundred sick or wounded men. That as the army corps advanced, all the hospitals should follow it closely, except such as were filled with sick and wounded, which should be replaced by others from the rear. After the battle of Königgrätz the wounded were collected into no less than twenty-eight different villages and other detached buildings scattered over the extensive field. Most of the places were found to be unsuitable. The Prussians had in this campaign 3,964 killed, 4,792 deaths from accidents and disease, and 16,191 wounded; 14,000 wounded of the Austrian army fell into the hands of the victors, so that 30,000 wounded were received into the Prussian field hospitals within a few days, causing a great and unexpected strain upon their resources. The number of the medical officers and hospital attendants were found to be inadequate! Cholera broke out the day after the battle of Königgrätz. There were in all about eight thousand attacks in the army. The strain upon the medical staff and hospital corps can be but imagined, it cannot be described. Owing to the overcrowding many deaths occurred from pyæmia and hospital gangrene, and nearly half those operated on died. At the close of the campaign the first line of the Prussian army numbered with camp followers, etc., 250,000, or a front of many miles of extent, the positions in many instances at a distance from all railway communication and only to be approached by country cross roads. Several of the railways had also been destroyed. In its rapid advance, twenty to thirty miles a day, the army had out-marched its supplies. There was great difficulty consequently experienced in evacuating the wounded and sick at first, and so relieving the pressure on the field hospitals. The season was generally favourable for operations in the field. Independently of the wounded, the average sick-rate was not higher than 2·5 per cent. The army suffered more from heat and dust than from cold and rain. They marched without tents, wore no socks, but wrapped their feet in linen, which was more cleanly and more easily washed, did not blister their feet or wear into holes, and admitted of healing applications being applied more easily. The foot-sore cases were inconsiderable. Some regiments made the campaign without knapsacks and fared as well as those who carried them. The falling out was trifling except amongst men of dissipated habits. The men were for the most part between the ages of 20 to 28.

After the armistice the sickness increased, and was attributed to the previous marching, consequent fatigue, and irregularity in the distribution and preparation of food, the imprudent indulgence in watery potatoes, and the use of water contaminated with animal impurities. Each army corps had a train depôt in which everything necessary for the equipment of an hospital was under one roof, *viz.*, ambulance, litters, medicines, surgical instruments, appliances, bedding, clothing, utensils, furniture, material, wagons, etc. Since 1822 "nursing sisterhoods" had been established at Berlin. The campaigns in Bohemia were the starting point of the methodizing of the work to be done by these and other aid societies. In Berlin a central association for the care of soldiers wounded in the field was formed, and the Society of St. John, a branch of the Old Knights Hospitalers of Jerusalem, did excellent service under the successful management of Count Stolberg. Depôts were established at all the railway stations near the seat of war. Medical attendants and nurses were engaged, and a regular company of sick-bearers with litters to assist the regular service in carrying wounded from the field was directed by a Knight of the Order. In Austria there were then twenty-three garrison hospitals, whose stores provided thirty-seven field hospitals and eleven ambulance corps. The fixed hospitals were calculated to accommodate five hundred wounded each, and their number depended upon the necessities of war. All the wounded likely to recover quickly and return to the ranks were received into them as well as all those who could not be further removed. All others were sent in country carts to the hospitals in the rear. In 1869 Surgeon General Sir Thomas Longmore, Professor of Military Surgery, visited Berlin in order to inspect the improved arrangements for the transport of wounded by railway ambulance trains, and the exercises of the Kranker-Frager Companies. The old system of laying the stretchers upon straw placed in the goods' wagons was being replaced by methods for suspending them by elastic rings, or by placing them upon springs arranged for supporting the stretchers on the floor. But on a long journey there was as yet no provision, in addition, for cooking a few hospital necessaries, etc. The review of the "Bearer Companies" was carried out in the most satisfactory manner, and showed that the men had been thoroughly trained in their work, and it was sufficiently evident to him that the practical application of the exercises on the battlefield of properly applying splints, bandages, tourniquets, etc., and the proper carriage of the wounded would contribute towards saving many lives that would be otherwise lost, but would especially be the means of preventing the aggravation of fractures and other injuries to such an extent as without them would render all attempts at conservative surgery unavailing. The improvements which had been introduced into the Prussian ambulance system were shortly afterwards put to a severe test in the Franco-German war of 1870.

In order to insure unity of purpose and combine responsibility with power, it had already been laid down in the regulations issued for military hospitals in Berlin in 1869, that the chief surgeon has command over the field hospital and the military medical and administrative personnel. During the war three sanitary columns of detachments were attached to each army corps, each column divisible into two equal and similar sections. A number of wagons or country carts, well littered with straw, were added when an action was imminent. The ambulance carriages of the detachments were not allowed to be used for the evacuation of sick or wounded, but were confined strictly to battlefield purposes—were pushed forward as far as possible, and were sometimes under small arm fire. Four men were allowed to each stretcher: two to carry the wounded men, and two as reliefs and to pick up arms and kits. The wheeled supports for the stretchers were found on many occasions extremely useful. Diagnosis tickets were systematically made use of, and afforded a useful guide to the several medical officers as to whether the wounded should, from the nature of the injury, be brought under shelter at once or sent to the rear. Twelve field hospitals were allowed to the army corps in addition to the sanitary detachments—four for each infantry division. Each hospital could accommodate two hundred sick. To each army corps was also allotted field, medical, and store reserves for the stationery war hospitals. There were also hospital reserve depôts intended to supply medical, surgical, and hospital stores to various services in the field, one for each army corps. "Etappen" or rest hospitals were established along the line of railways for the temporary accommodation of the sick troops proceeding to the front, or of the invalids or sick returning to the rear, eighty or hundred miles apart; if on "Etappen" roads, fifteen or twenty miles from each other. Stationary and reserve hospitals were also provided; the railway ambulance trains were vastly improved and systematically used for the evacuation of the sick and wounded. Large numbers of auxiliary aid societies further assisted with all the improvements suggested by the war in Bohemia in 1866. All officers with the field hospitals and sanitary detachments were mounted. Consulting surgeons, eminent in the civil hospitals, were added to the army to assist in the ambulance detachments and field hospitals, and after a battle worked at the head-quarter bandage places. For the establishment of the field hospitals, situations were designated as near as possible to the operating forces in a locality, in which suitable buildings could be obtained, to be selected by the chief surgeon. An abundant supply of disinfectants was available during this campaign, and the antisepticising of the wounds was most extensively employed. The sanitary arrangements in the field hospitals were improved. These had been very unsatisfactory in the previous campaign. Most of the stationary and reserve hospitals were made of cheap wooden huts, or partly brick and wood. Numerous tent hospitals were also established. A good supply of air was found to have entirely checked hospital gangrene and other infectious diseases. As the army advanced into France, great relief was obtained by the well-planned evacuation of the wounded by the sanitary trains to Germany direct, by which means the following advantages were derived: 1.—Room was made for the constantly increasing sick and wounded. 2.—The hygienic conditions of the field hospital were improved. 3.—The hospitals could be consequently kept moveable. "In suitable weather tents were made use of to relieve the hospitals and treat certain cases. Experience proved thatthe majority of patients could be more rapidly cured by the influence of the abundant volume of air, and that febrile diseases, with a high temperature, underwent a favourable change, but that during the convalescent stage, treatment in the solid buildings became imperative.

Each soldier during the campaign carried a "first field dressing," now coming into general use for the first time in European wars. But still the effect of a want of preparedness in anticipation of war was amply shown during the siege of Metz, that historic fortress where the distinguished military surgeon and discoverer of the ligature, Ambrose Parè, made his début in the fifteenth century. It was as ill-provided with medicines and hospital stores as with warlike material and food. The most important medicines were soon exhausted. Instruments were wanting, and permission had to be obtained from the Germans to introduce chloroform. There, from the 15th August to December 1870, 43,000 were admitted to hospital and 5,474 died.

Many long and difficult marches were performed by the Germans, and in order to prevent the bad effect of the sight of stragglers and fatigued men on these, every regiment in the Saxon army was followed by a medical officer and two hospital aids, with a wagon for the knapsack of the fatigued men or their transport. Water and wine were also carried and issued occasionally. In the cold weather blankets were issued, and they were found to be such a comfort that the additional weight was borne without a murmur. Supplies were obtained by requisition when the troops entered France, but owing to their great uncertainty and irregularity, the field hospitals suffered. The magazine supplies were excellent, and when fresh meat could not be obtained, the celebrated pea-sausage was issued, but when used too exclusively, the men turned against it. To obviate this, preserved and smoked meat, bacon and white beans and potatoes, when possible, were issued. The ration included one ounce of roasted coffee. The want of a knowledge of cookery was much felt, and of articles to give flavour, such as vinegar and spices.

The average for the principal battles fought in Bohemia in 1866, and the war of 1870, of all engaged, whether exposed to fire or not, was as follows: 0·75 per cent. killed, 2·83 per cent. wounded, 0·54 per cent. missing, total 4·12. In the Austro-Saxon army the highest percentage was when 150,000 were actually under fire, 3·86 per cent. killed, 11·87 per cent. wounded. In the Franco-German war the largest was at Vionville—2·16 per cent. killed and 6·77 per cent. wounded. Of the wounded to be immediately provided with surgical assistance in the field, one-third may be classed as severe, the remaining two-thirds as slight injuries.

At the Congress at Brussels, opened on 27th September 1876, under the presidency of the King of Belgians, amongst the subjects discussed was the "help to the sick and wounded during the war." The section devoted to ambulance was very complete, and the improvement and completeness of the ambulance trains for evacuating the sick and wounded was very noticeable. The fundamental principle upon which the railway transport trains for conveying sick and wounded was now arranged was based upon the rapid transformation of existing carriages, the ordinary fourth class of the Prussian lines open at the ends. Between each pair of carriages was a folding platform, and the stretchers were arranged in two tiers to fit on to a shelf-piece with spiral springs, ventilation central in roof. Each train numbered twenty carriages for sick and wounded, ten in each, besides the carriages for medical officers, one for a surgery and pharmacy, two kitchen wagons, etc. Many improvements were suggested for the better adoption of country carts, which, in Prussia, were two-horse wagons for severely wounded, with two stretchers each. The new Prussian tent for field hospitals contained twelve beds, which were put together from simple pieces of wood cut to regular sizes and shapes, so as to facilitate their construction and make them uniform. The tents had a double cover, the outer of which was made waterproof. Between the two covers of the roof the ventilation was carried on. The pole was of wood. Eighty tents of twelve beds each were allowed for an army corps—total 960 beds. In September 1884, conferences were held at Geneva by representatives of the various Governments and national societies, from which it appeared obvious to our representative, Sir Thomas Longmore, that there was only one principle on which a system of voluntary aid could be adopted for military organization in time of war, and that was, that the voluntary must for the time become incorporated with the military establishment, while the sphere of activity of the former must be relegated to such a part of the military operations as the military regulations and the actual commander on the spot may determine. On any other principle a "volunteer aid establishment" would, in his opinion, interfere with and impede the operations of any organized force. In order to ensure that the national aid tendered in war should be good and sufficient the conference laid down: (1.)—Sick transport columns should be formed in time of peace, and actively practised at suitable times, in order to train and habituate the personnel to habits of discipline. (2.)—That the intellectual qualities of female nurses should be carefully examined into and it should be ascertained whether they were strong enough for performing the services which would be required of them. (3.)—A reserve establishment should be organized beforehand to fill up vacancies during war.

Experiments, which had be made at Vienna, Paris, Aldershot, and at Geneva in 1883-84, with a movable electric light wagon, having established the possibility of lighting a large battle-field at night sufficiently to enable the wounded to be removed, in aid of the ambulance, it was recommended that for this purpose it should be utilized in future wars. The conference also recommended that antiseptic dressings should be employed as a rule in the surgical service of all armies in the field, and in the service of the Red Cross Societies. In 1885 an exhibition of moveable hut hospitals for ambulance service took place at Antwerp. There were no less than sixty exhibits, showing the advancing interest taking place on this important object of how best to alleviate human suffering when appealing to human skill. Improvements were shown in many particulars. The prize hut was of wood with felt for filling up the frames a layer of cork between inner and outer coverings to protect from cold and heat alternately. The frame and felt were impregnated with silicate of soda to reduce their inflammability. This hut contained ten beds.

Since the war of 1870 the ambulance service of the French army has been wholly remodelled, and the old dressing material and surgical appliances are in process of elimination, antiseptic wools taking their place. The old pattern tent with ropes has disappeared, and been replaced by one with iron and wooden ribs, much more roomy. A tent "tollet" with window frames is used as an operating one, not heavy, and easily put together. A law of July 24th, 1873, and of March 16th, 1882, created the autonomy of the military medical service, and a further clause was issued 26th October 1883, by Article 16, in which it was laid down, "that in all that concerns the duties of the medical service, the military medical officers have authority over all personnel, military or civil, attached either permanently or temporarily to their service." Railway transport for the evacuation of the sick and wounded are classed under: (1.)—Permanent sanitary trains. (2.)—Improvised sanitary trains.

The first consists of sixteen carriages, of which eight are filled up with bunks or cots for sick: one as a surgery and dispensary, and one as a kitchen. One carriage for medical officers, one for orderlies, one for food store, one for linen stores and articles of combustible nature. All communicate by a central passage which extends the whole length of the train. These rolling hospitals are put together occasionally for practice, with all the fittings kept ready in peace time, but are not permitted to go out of the French railway system. The improvised hospital trains are prepared by the staff of the stationary hospitals on the lines of communication, and are composed of twenty-three to thirty covered goods' wagons fitted with the apparatus (Bey) for the suspension of the stretchers, with five carriages for attendants and stores. The apparatus is easily adjusted and enables twelve stretchers to be suspended in each wagon. It is laid down that every train carrying stores to the army in the field is to have one wagon fitted up with Colonel Bey's appliances. On its return journey it is filled up with the staff *des hôpiteaux d'evacuation* and filled with wounded for transport to the rear.

The field hospitals form an integral portion of each *corps d'armée*, each for a hundred men, but capable of being divided into two equal parts. From them the sick and wounded are evacuated to the permanent hospitals of the locality, and the auxiliary hospitals formed by the "Red Cross Societies," which are authorized to help in time of war the military service. Certain places are mapped out for the "Red Cross Societies," where they are to form at each an hospital of not over two hundred, or less than twenty beds, and give to the sick and wounded the gifts offered by the public. They are all under the general officer commanding the line of communication, but are not permitted to mix with the fighting lines, or the field hospitals, which are in the hands of the regular medical service. They provide entirely for the patients transferred to them, until they have either recovered or died. The whole of the auxiliary hospitals are under the inspection of the medical director and military authority of the district. In any future war no foreign ambulance will be allowed to work independently as in the campaign of 1870. The personnel of the auxiliary hospitals when employed with the army is under military law, and subject to military courts. They have temporary hospital buildings, their own ambulances and military trains, very completely organised, and it is to these auxiliary hospitals in a future war that the greater part of the sick and wounded will be drafted from the front. They are entirely maintained by philanthropy, and without expense to the State, and under the medical service of the army are free to be employed with that portion acting beyond the frontier. They are obliged to furnish every six months to the minister of war a return showing the number of beds they are prepared to equip at each of the places allotted to them. The "Ambulance" of the French army corresponds with our "Bearer Company," and supplements the post of succour under fire.

Each *corps d'armée* has four hospitals, *viz.*, one for the quarter-general, one for the staff and corps troops, one for each division of infantry, and one for the brigade of cavalry.

They are arranged on three scales:—

(*a*)—A division of infantry or quarter-general, and for corps troops.

(*b*)—A brigade of cavalry and fortified places.

(*c*)—A column operating in mountainous places and Algeria. They co-operate with the field hospitals.

All European armies have now adopted a first field dressing, rendered antiseptic by one part of corrosive sublimate to 1,000. It is claimed that when the number of wounded is likely to be excessive, the supply of material so carried by each officer and soldier is invaluable, and that occasions may arise when no other dressing is available.

The advantage of a good antiseptic dressing in war is, that wounds may be left for a considerable time without being disturbed, after the first application, thus facilitating rapid transport to the rear. The necessity of introducing antiseptic treatment into field surgery practice led to considerable changes in the surgical equipment of the German army. The various improvements were exhibited at the Tenth International Congress held at Berlin, 2nd and 9th August 1890.

Each "Bearer Company" is allowed eight of the new pattern ambulance wagons, each of which carries four lying-down patients, and five spare stretchers on the top and five inside. Each army corps in time of war has still three of these companies. One to each of the two infantry divisions, and the third at the disposal of the officer in command of the corps. The new pattern eight ambulance wagons carry seventy-two stretchers; the old pattern carried fifty-six. Men exempt from peace service are put in charge of any country wagons requisitioned to supplement the regular hospital service. Each stretcher carried by the sanitats' detachment has an adjustable head rest frame (with pillow), to the back of which the surgical havresack is attached. Those men who are to become stretcher-bearers in time of war are now trained while serving with the colors; they must be in their second year of service, strongly built, of good conduct and intelligence, and able to read and write, and sufficient in number to supply the requirements of the sanitats' detachment on mobilization. In addition four per cent. per company of infantry battalions are trained to act as supplementary regimental stretcher-bearers during an action. These last are not under the protection of the Geneva Convention, and wear red brassards instead of white brassards with the red cross.

A course of instruction in first aid—twenty lectures—is given annually by a selected medical officer in each garrison. In each barrack there is an instruction room. An annual training stretcher-bearer drill follows of those men who have passed through the course of lectures in first aid. This course lasts ten days. Four of the ten days are taken up with wheeled transport. A medical officer superintends. Medical officers attending the training in "stretcher-bearer drill" are mounted as in the field. In one day in the ten all the medical officers of the garrison and the field apothecary attend to become practically acquainted with the material used in the field and the method of packing the articles. Men trained as stretcher-bearers, who have passed into the reserve, are called out annually to attend the course. At the end of the course the bearer companies are inspected by the general and principal medical officer. A field disinfecting apparatus is present with the army, consisting of a boiler and disinfecting chamber on a small four-wheeled carriage, which is of light draft, and can be rapidly moved on good roads. A new pattern tent, double the size of the older one and fully exposed to the light on one side so that operations can more easily be performed, has been adopted for the dressing station. The advantages claimed for the moveable hospital huts are that they supplement the fixed hospital accommodation of garrisons when an unusual outbreak of disease occurs. That by bringing them to an area where infectious disease in an epidemic form exists, its spread may be checked by isolation of the cases, and the transport of serious cases is lessened by the erection of these huts in places where large numbers of wounded are lying. The new pattern is a hut with waterproof canvas instead of felt, as being more easily repaired. A certain number are kept in the equipment of garrison hospitals for use when required. Two kinds of diagnosis labels are used—white, signifying that the man may not be removed; and red, that he is transportable to the rear.

An antiseptic box has been introduced into the equipment of the bearer companies. Hospital trains now consists of third class carriages with the new system of supporting stretchers, sleeping car, kitchen, etc.

A new pattern tent has been introduced for the dressing station, tent for twelve patients, a circular hut for winter use, sixteen beds and ward equipment with a mohler store. A canvas hut for sixty sick or wounded with kitchen, with washing utensils and bath-room.

The difficulty of searching for the wounded on the night after a great battle has been one which has long occupied the attention of military reformers, and the army medical service in Austria determined to try how far the electric light may be utilized for this humane end. It has been found that powerful search lights, with reflectors, are very effective on open ground, but in cases where the battle has raged over a wide extent of country, or where the fighting has occurred amid woods and brushwood, such luminants are not of much use. Hence it was resolved to experiment with the electric light in a new form. The men of the army medical service were sent out at Gratz at night, each armed with portable electric lanterns, which were fed by accumulators contained in their knapsacks. The experiment was fairly successful, and it is likely to be repeated.

The latest improvement suggested is that of organizing a certain number of mounted bearer companies to keep pace with the rapid movements of cavalry in the field. Brigade-Surgeon Williams, P. M. O., New South Wales Military Forces, has proposed for this purpose, in order to save life and engender a feeling of confidence among all ranks, that each of these should consist of 5 medical officers, 8 non-commissioned officers, 28 rank and file, 20 horses for ten specially-constructed light ambulance wagons, 4 for two water-carts, each containing eight gallons, 8 for four light ambulance store wagons, and 6 for twelve cacolets; total 79 horses. The medical and surgical equipment being of a suitable and special pattern. For the same purpose Captain Tomkins' 'Tortoise' flying field hospital equipment, after a successful trial at the Russian infantry manœuvres, has recently been ordered to be more severely tested by a further official trial at the cavalry and artillery manœuvres, under the command of the Grand Duke Wladimir. The result is stated to have been very gratifying, an experiment having been made which proved its adaptability to an emergency, and that it could be quickly packed into a country cart pressed into the service, when the wagon was disabled. During the cavalry manœuvres the tent was frequently pitched in eight to ten minutes, wagon inside, after marches of thirteen to twenty-seven miles. This system was in use at the manœuvres in Finland as a field hospital, and has been used for that purpose at the manœuvres of France, Austria, and, during the autumn manœuvres, the Guards in Hampshire accompanied them and the 1st South Wales Borderers. The Grenadier Guards had an ordinary service wagon, with a tortoise tent fitted to it.

In England the volunteers have given a great impulse to the ambulance system and have showed much interest in its success. Each brigade has its bearer company, formed by the mobilization of sections from each corps under the senior medical officer of the brigade; besides these there are the independent companies of the volunteer medical staff corps aided by Government with drill instructions from the medical staff corps, etc. These companies are inspected periodically by principal medical officers of districts and reports upon their efficiency made to general officers commanding. The Manchester companies, which was under my supervision in the N.-W. district, had an excellent band and had no difficulty in recruiting. Camps are formed at intervals and occasionally training takes place at Netley or Aldershot. In the event of invasion, or foreign war withdrawing the regular companies, they would form an important reserve, as would also the bearer companies of the militia medical staff corps. Attached to some of the large colliery districts are also ambulance brigades, one of which, numbering 350 in two sections under the command of Colonel Seely, M. P., which had travelled from the midland counties, was inspected by Her Majesty at Windsor on 6th May 1893. They wore a neat blue, cloth uniform, braided with red, military peaked caps, white belt with black bandage cans, and bore the St. John's ambulance badge upon their arms.

At the Fifth International Conference at Rome on 21st April 1892 of the Red Cross Societies, the King and Queen of Italy, desirous of marking their sympathy with its objects, announced, through the President, Count Somaglia, that they had instituted a prize of 10,000 francs for the best appliances for carrying the wounded from the field of battle and rendering front aid to them. When bidding the delegates welcome, the war minister said, although armaments did not diminish, it was encouraging and cheering to see the noble rivalry of humanity and charity ever striving to minimize their effects.

In principle, the existing arrangements for medical assistance in the field, and for the removal of the wounded therefrom, are now in great measure identical in most European armies. The English system may be briefly summarized: In the field there is a medical officer with each unit-regiment of cavalry, battalion of infantry, body of artillery, etc. He has at his disposition the trained regimental stretcher-bearers of his particular unit, two per company or troop. To each brigade is attached specifically one bearer company and one field hospital; to each division an additional field hospital. For an army corps the medical establishment consists of the field hospitals and six bearer companies, exclusive of the regimental aid; and in addition to this a certain number of officers of the medical staff are utilized for staff purposes. The entire service is under the command of a surgeon-major-general, subject to the authority of the general commanding. There are three stages for the wounded man between where he falls and the field hospital, where he either temporarily remains if his case is not serious, or whence he is sent back to the base hospital if he has been severely wounded. The first stage is from the fighting-line to the collecting-station, where he has fallen, he receives medical aid from one or other of two sources, whichever may the sooner reach him: the surgeon of his own particular unit, accompanied by that officer's orderly from the bearer company belonging to the brigade, carrying the field-companion, water-bottle, and surgical havresack, or a surgeon belonging to the bearer company, with a private similarly equipped. At this stage the surgeon, whether of the unit or of the bearer company, as the case may be, affords the wounded man merely temporary aid, and does not undertake any serious surgical operation. The patient is placed on a stretcher which may belong to the bearers of the unit or to one of the eight stretcher detachments of the bearer company, and is carried back to the collecting-station, which, while if possible under shelter, is as near as may be to the fighting-line consistently with safety. The collecting-station is in charge of a sergeant equipped with field-companion and water-bottle and a small reserve of bandages and first dressings to replenish the surgical havresacks of the stretcher-bearers. From the collecting-station to the dressing-station, farther rearward, and if possible out of fire, a certain specified number of ambulances ply, loaded with their complement of wounded men, each vehicle under the care of a corporal or private of the bearer company. These two stages, from the fighting-line to the collecting-station and from the collecting-station to the dressing-station, constitute the "first line of assistance."

At the dressing-station, located if possible in a building, if not, in a tent, and in proximity to a good supply of water, the medical officer in command is on duty, assisted by a surgeon, a sergeant-compounder, a cook, etc. Here the wounded receive more detailed attention than could previously have been paid to them. Beef-tea and stimulants are supplied when needed; minor, and, in case of emergency, even capital operations are performed. As the wounded are dressed they are placed in the ambulances plying between the dressing-station and the field hospital, which stage is known as the "second line of assistance." The collecting and dressing stations may have to be advanced or retired according to the ebb or flow of the battle, but the general principle holds good that the two shall never be far apart, so as to shorten the journeys in the first line and thus bring the wounded within reach of surgical aid as speedily as possible. In the Egyptian campaign of 1882, a quarter of an hour was held to be the extreme length of time for the wounded man to lie on the field before receiving assistance; but then there were but a few hundreds of men to be dealt with, in contradistinction to the thousands of wounded which a great battle necessarily produces.

The German corps has twice as many regimental medical officers per thousand men as the English. It has sixty more stretcher parties, twice as many beds in field hospitals, but fewer ambulance-wagons by one-half. Taking the means of carriage from fighting-line to dressing-station, the English corps has 184 stretchers and carriage for 224 wounded per ambulance-wagon, making 412 in all. With the average distance of dressing-station from fighting-line under these arrangements taken at fifteen hundred yards, the number of journeys to and fro that could be estimated for, would not exceed five, on fifteen hundred wounded moved by carriage. Taking fifty per cent. of the wounded as requiring carriage from the field, this would give three thousand wounded that would arrive at the dressing-stations for transfer to the rear, or ten per cent. of the whole force.

This much of detail has been gone into in regard to the present system of dealing with the wounded in battle, with the motive of accentuating the contrast between that system with its promptitude of succour, and the harsher conditions which must inevitably be endured by the wounded of future warfare.

The late Dr. Billroth, the greatest of Austrian surgeons, held that "we must come to the conclusion that in future it will be no longer possible to remove the wounded from the field during the battle by means of bearers, since every man of them would be shot down, as bearers would be more exposed than men in the fighting-line; and the most that can be aimed at is that the wounded man of the future shall be attended to within twenty-four hours." Bardeleben, the Surgeon-General of the Prussian army, has said: "Some urge an increase of bearers; but we must not forget that bearers have to go into the fire-line and expose themselves to the bullets. If we go on increasing their number, shall we not also be simply increasing the number of the wounded? The number of men provided for the transfer of the wounded now exceeds one thousand for each army corps. It is no true humanity that, in order to effect an uncertain amount of saving human life, a number of lives of other men should be sacrificed. The whole system of carrying away the wounded on litters during the battle must be abandoned, for it is altogether impracticable." There are many other testimonies to the same effect. In the Franco-German and Russo-Turkish wars Archibald Forbes, the veteran war correspondent, personally recognized and wrote in that sense in his war correspondence, that the losses among the bearers and surgeons were so great that the service already "approached impracticability." And added that "in the warfare of the future the service as now existing will be found utterly impracticable, since, with the improved man-killing appliances certain to be brought into action, the first battle would bodily wipe out the bearer organization carried on under fire."

The battles of the future may or may not be less prolonged than those of recent campaigns. We cannot prognosticate. The battle of Gravelotte lasted from noon until 10 P.M.; the battle of Mars-la-Tour right round the clock, from 9 A.M. to 9 P.M. It is certain, because of the vast strengths engaged, that the battles of the future will cover much more ground than heretofore, and it is probable that the fighting will be more stationary.

Most of the European powers have equipped their armies with one or other form of the new small-bore rifle, and those which have not completed their re-armament are making haste to do so. At Gravelotte the losses of Germans by the long-range chassepot rifle were 5,000 dead and 15,000 wounded, one-third of the latter dangerously, and having to be carried off the field by the *krankertrager*, to effect the removal of which 1,000 bearers and 500 litters were required, each party of two bearers with one litter making the journeys from the fighting-line rearward to the ambulance wagons and back to the field.

The only type of new weapon, the results of the fire from which have been actually tested on the battlefield, is the Männlicher, which was used to a considerable extent in the Chilian Civil war of 1891. As is generally known, the eight-millimetre projectile which the Männlicher throws is much lighter and of much flatter trajectory than any of the old larger bullets. Owing to its higher velocity and pointed shape, its power of perforation is extraordinary. In the matter-of-fact language of Bardeleben: "Owing to the immense velocity of the Männlicher bullet, and its small surface of contact, it meets with little resistance in striking, causes little commotion of the neighbouring parts, has no time to stretch the various tissues it encounters, and merely punches out a hole, carrying the contused elements before it clean out of the wound, without seriously damaging the surrounding wall of track." The now obsolete bullets fired from great distances and striking a bone frequently glanced off or rebounded. This will occur no longer. The new long-range projectile, if it strikes at all, has sufficient force to pass through, cutting any vessels or organs it may meet in its path. It is, therefore, all the more deadly. Whereas the accepted estimate of casualties in modern warfare has been in the ratio of about four men wounded to one killed, the percentage in the Chilian fighting is authentically given as four killed to one wounded. This ghastly proportion will probably not maintain itself in future battles on a large scale, but there can be no doubt that the fighting of the future will be deadlier than that of the past. Yet the properties of the new bullet are not entirely lethal, although it will slay its thousands. Its characteristic of absence of contusion, which contusion from the old bullet frequently stayed the bleeding of injured vessels, must result in more frequent deaths from hæmorrhage, more especially in the inevitable lack, in the future, of prompt surgical intervention. But the wounds it causes, if they do not produce immediate death, or speedy dissolution from hæmorrhage, are expected to be more amenable to treatment than those which were occasioned by the old bullet.

It is remarkable that the more modern battles of Europe in which great numbers of men have been engaged—battles in which were used rifled cannon and small arms—have afforded greatly less percentages of casualties than those of earlier battles in which smooth-bore cannon and muskets were the sole weapons of fire. At Borodino, in 1812, there fought 250,000 French and Russians, with a result of 80,000 killed and wounded. At Salamanca, in the same year, when 90,000 English and French were engaged, the casualties amounted to 30,800. In each case the proportion of casualties to the forces engaged was one-third, and the proportion was the same in the battle of Eylau in 1807. In the battles of Magenta and Solferino in the Franco-Italian war of 1859, when the French armament was in great part rifled, the proportion of killed and wounded to the total forces engaged was but one-eleventh. At Königgrätz, in 1866, the proportion was one-ninth. In the two-days' fighting before Metz in August 1870—the battle of Mars-la-Tour on the 16th, and the battle of Gravelotte on the 18th—there were in all on the ground about 450,000 Germans and Frenchmen. The casualties of the two days amounted to 65,500, affording a proportion to the total strength of one-seventh. These figures work out that the old Brown Bess and the smooth-bore guns inflicted proportionately more injury to life and limb than occurred in the battles later in the century with all the appliances of improved armaments. But the largest army placed on a battlefield on any one occasion by an European power within the present century, the Prussian army which fought at Königgrätz, did not amount to more than 260,000 fighting men. To-day the war strength available for the field of the German Empire is close on 2,500,000 men; that of France, 2,715,000; that of Russia, 2,450,000; that of Austria, 1,600,000. When the first great battle of the next great war comes to be fought, a million of combatants will be in the field. On the percentage of 1870, and putting aside altogether the effects of the recent developments in man-hurting, the casualties will exceed 140,000. According to the existing ratios, of this number 35,000 would be slain, 70,000 would be comparatively slightly wounded, and 35,000 would be severely wounded. In the absence of actual experience, the Chilian statistics could not be relied upon, at all events, in full. It follows that if the wounded of the next great battle are to be dealt with as the present arrangements prescribe, apart from the gleaning of the bearers during the battle, surgical assistance will have to be provided for 105,000 wounded and hospital accommodation for about 70,000, *viz.*, the 35,000 severely wounded and one-half of the comparatively slightly wounded.

For a considerable period the German War Office have had in view these contingencies. Since 1871, and especially since the new regulations of 1878, the German ambulance system has been steadily improved. In 1870-71, 35,661 persons were officially employed by the ambulance departments of Prussia and the other States of the North German Confederation, not counting Saxony and Hesse. The number has been considerably increased since then. There were 5,000 bearers in 1870, and since then each increase in the number of troops has been accompanied by an increase of this special staff, and they are much more carefully trained than they were in 1870. In that year there were only 124 persons to each sanitats' detachment, there are now 231. The Red Cross and other ambulance societies for

Prussia and the neighbouring States contribute 4,276 persons in case of war. Great improvements have been made in the ambulance trains, which consist of forty-one carriages, in which are three hundred beds, complete kitchens with steam pipes, etc. As regard field hospitals, Germany is in the first rank of nations. The number of beds available in hospitals has been largely increased. In 1870, the North German Confederation had 34,026 beds at its disposal officially; at present the German military ambulance department can count on 150,000 beds, of which at least 40,000 can be available within twenty-four hours. Besides this official provision for the use of the sick and wounded in war, there are numerous private societies with well-trained male and female staffs numbered by thousands, and with hospitals at their disposal, so that it is clear that Germany's ambulance department is alive to its enormous responsibilities. The German wounded in 1870 numbered 116,821 men, 14·8 per cent. of the total number in the field. Of these 17·300 died at once, leaving a percentage of 12·6 for surgical treatment. For the next war the German War Office calculates on a loss of 20 per cent. or 7,000 from an army corps complete in numbers. Of these, according to generally recorded experience, there would be 1,200 killed and 5,800 wounded; and of the latter about one-third seriously injured and two-thirds with slight injuries. For this number they can dispose of 150 surgeons, 300 ambulance assistants, and in round numbers 100 bearers. Thus each surgeon would have charge of twelve to thirteen seriously wounded men and twenty-six with slighter wounds.

As many men will, in future, wounded by small arms, be only temporarily disabled, and, if promptly treated antiseptically, will be in the ranks in a period of from fifteen to thirty days, it will thus be necessary to treat a large proportion near the seat of war and a large moving hospital accommodation where the entire treatment of a considerable proportion of the wounded may be carried and must be provided. The treatment should begin in the field at the earliest possible time after the injuries have been received, more especially as the sharpness of the wound will increase the risk of hæmorrhage.

In all armies many improvements in the arrangements for the care of the sick and wounded in war have thus been effected, and every nation now acknowledges that the soldier who fights the battles, and sustains the glory of his fatherland, deserves all that can be done to alleviate his suffering. By his valour great empires have been consolidated, and they have not been behind hand in reorganizing those services upon which his comfort so much depends.

To conclude: Stern experience of future warfare must one day force home upon the nations the decision whether their wounded and necessarily untended warriors in their thousands and their tens of thousands are to lie bleeding on the battlefields while the strife is raging above them; or whether the peoples of the civilized world shall take the accomplishment of the millennium into their own hands and bring it about in the words of the old Scottish paraphrase that—

> "No longer hosts encountering hosts
> Shall crowds of slain deplore;
> They'll hang the trumpet in the hall
> And study war no more!"

CASUALTIES IN MODERN WAR FROM THE POINT OF VIEW OF AN AMBULANCE SURGEON.

BY C. H. MELVILLE,
Surgeon-Captain, A. M. S.

The number of casualties that may be expected to occur in future wars is a matter of the greatest interest, not only to all classes of the army, but more particularly to the Ambulance Surgeon, on whom will fall the task of relieving the sufferers, and the extent of whose preparations must depend on that number. It is, therefore, important that we should consider how the recent changes in firearms, more especially rifles, will, as far as may be anticipated, affect the ratio of casualties.

Let us first consider the nature of these changes. On the face of the question we are struck by the great increase in destructive power, conferred (1) by the increased range of modern rifles; (2) by the increased rapidity with which they can be discharged.

Now these are not by any means unprecedented innovations. To go no further back than the beginning of the last century, we have in the changes from fire and wheel locks to flint locks, from these last to percussion locks, from muzzle-loaders to breech-loaders, from smooth-bore to rifled weapons, instances of similar increases in range and rapidity of fire in the aggregate, at least, even if not singly, quite as great as they advance for single loading breech-loaders to the modern magazine weapons. History then should throw some light on the effect that such changes have made in the ratio of casualties. Let us take, for instance, two wars of the present century, in which the statistics may be considered as being as reliable as can be hoped for: the first, the American Civil War, in which both sides were armed with muzzle-loaders; the second, the Franco-German War, in which both sides were armed with breech-loaders. In the former we find that the losses were very great—those on the Unionist side being at Antietam 13 per cent., and at the Wilderness 15 per cent., excluding missing; and in all other important engagements considerably more. In the Franco-German War, on the other hand, at Vienville, where the greatest loss was incurred by the Germans, this only amounted to 9·75 per cent., and at Gravelotte to 7·39 per cent. In the first mentioned campaign, the two sides were fairly equally armed; in the second, the French had a very marked superiority as far as the mechanical perfection of the rifle was concerned. We see, therefore, that the introduction of a further ranging and more rapidly dischargeable weapon did not, in this case at least, of necessity result in an increase in casualties. Let me quote the military authorities in support of a similar conclusion: Prince Kraft, in his letters on artillery, speaking generally of the increased range of modern weapons, states: "In later times battles continued to grow less and less bloody in proportion as more murderous weapons were discovered, and the range of missiles increased." And again in the same letter: "Thus we see that the greater the perfection to which weapons of war are brought and the longer their range the less bloody are the battles." My second quotation is from an article by General Keith-Fraser, in the "Fortnightly Review," for October 1884. He there says: "Neither in the death sides of Worth or Rezarville, nor in the terrible slaughter of Sedan, were the losses as heavy as those incurred by cavalry in the days of muzzle-loaders." We may fairly then conclude that any new increase in the destructive potentiality of weapons does not of necessity imply an increase in the casualties of the troops using or opposed to them.

The actual number or percentage ratio of casualties are not, however, the only questions with which the Ambulance Surgeon has to concern himself. He needs also to know the distribution of casualties on the field of battle and their nature, the relative proportion, that is, of killed, severely wounded, and wounded that may be expected. The answers to these questions must, however, be largely furnished by the tactician, and the information required for him is (1) to what extent will the extreme ranges of infantry fire be utilized; and (2) at what distance from the enemy's position will the decisive infantry fire-fight take place.

With regard to the first question there are conflicting opinions; it is obvious, however, that the natural features of the battle-field will largely affect the answer in any particular case.

It is not, however, of such importance, as to the second question. It is, I believe, an accepted opinion that, as a rule, during an attack infantry will not compete with artillery at ranges where the fire of the latter is the more effective, and that, therefore, during an attack on a position there will, under ordinary circumstances, be a range beyond which infantry will not, as a rule, open fire, and will, it may also be inferred, be kept as much as possible under cover. During the artillery preparation for the attack then it may be anticipated that the losses of the infantry will, as far as possible, be reduced to a minimum, and also that these losses will not begin to be serious till the preparation having been properly carried out the infantry are pushed forward to ranges where their own fire has a preponderating effect. From this point to another point, where the fire of the infantry of the defence becomes so severe that further advance is for the time impossible, the losses will gradually increase, but as Clery points in his Minor Tactics, the advance up to this point will be carried ont with as little delay as possible. When this point is reached a more or less prolonged fire-fight will be carried on, on the result of which, the success or otherwise of the attack will depend. It is at this point, therefore, that the great bulk of casualties will occur, and the number that will occur at large ranges during the attack will depend largely on the rapidity with which the advance shall have been carried out. I would anticipate then that the infantry casualties would begin at 200 yards, and gradually increase up to 800 or 900 yards. Between that and 500 or 600 yards the decisive fire-fight of the infantry may be expected, and here we should find the bulk of the casualties.

The nature of the casualties will depend on, mainly, the amount of energy expended by the bullet in its passage through or into the body, that is, practically, by its momentum at the instant of impact, in fact, by the resistance met with in its passage, and its power of penetration. If the momentum be great and the resistance great, compared with the power of penetration, the injury will be excessive; if there be little or no resistance, however great the momentum, the injury will be slight. Added to this at the closer ranges, where the momentum is very great, we have, as pointed out by Professer Horsley, an explosive action produced in soft or semi-fluid confined tissues, *e.g.*, brain, muscles, when firmly contracted, etc. It would appear from experiments that have been made that this explosive action will not occur at ranges greater than 300 or 400 yards. It is probable, therefore, that all injuries, not being purely flesh wounds, inflicted within these ranges, will be very severe, and if affecting the trunk, upper arms or thighs, probably rapidly fatal. A purely flesh wound will depend for its severity on the condition of the muscles penetrated; if these be flaccid, it will probably be a clear penetrating wound, if firmly contracted, more especially in the case of the larger muscles, biceps, muscles of the thigh and buttock, severe laceration. At ranges above 400 yards wounds of the larger bones will, owing to the resistance these impart, be severe and shattering, all wounds not affecting bone or vital organs comparatively slight. Now we see at once the great importance of knowing the probable range at which the bulk of casualties will occur. If this be, as seems certain, beyond 400 yards, the injuries will not be, as a rule, severer than those met with in previous wars. Wounds will tend, in fact, to be either very severe and probably fatal, as in cases where the body or head is penetrated, or the thigh bone or shoulder joint shattered; or comparatively trivial, as when no bones are affected and the wounds superficial or confined to the limbs. Probably wounds of the large vessels of the limbs will tend to be more fatal, owing to the cleaner cutting action of the small-bore bullet; on the other hand, owing to the comparative absence of shock in a purely flesh wound by a small bullet, the wounded man should be more able to take measures to control the hæmorrhage of any vessel distally to the upper third of the thigh or upper arm. I would venture to predict then that, at the range where the decisive fire-fight is carried on, wounds will tend to be fatal, or moderately severe only; and that very severe or severe wounds will not commonly come under treatment. At the longer ranges wounds will more and more tend to be slight, owing to the diminished momentum of the light bullet, and the comparatively high penetrating power conferred by its diminished calibre. It is very difficult to state actual figures on this point, but I would venture to lay down that, at the range where the decisive fire-fight occurs, taking that to be 600 to 800 yards, and taking further the proportion of severe to slight wounds observed in the Crimea (Longmore's "Gunshot Injuries," p. 614), it may be anticipated that all wounds of the face, head, or chest, penetrating or implicating bone, all penetrating wounds of the abdomen, perinæum, and of the spine will be probably rapidly fatal, these being about one-third of the total severe wounds. Further, that all severe wounds of the thigh and upper arm will tend to be fatal, when this severity depends on the implication of the bone. This will further largely reduce the number of severe wounds coming under treatment, probably to less than one-half the proportion previously observed. On the other hand, all slight wounds will remain slight, and then much will further be increased by these wounds whose severity was caused in former times by the want of penetration of the older bullets, or their larger calibre.

Having now considered the number, nature, and distribution of casualties, we come to the more special question of their removal.

There the increased range of the modern weapons will most seriously affect the work of the ambulance officers. The distances which will have to separate the different lines of assistance must, if the present system is observed, be greatly increased. It is difficult to see how the collecting station can be closer to the enemy's position than 2,500 yards, roundly speaking, one mile from the position where the majority of casualties may be expected to occur. Therefore to remove one wounded man from that position to the collecting station, the stretcher detachment will have to cover two miles of ground; three-quarters of an hour at least will be occupied in this manœuvre, during the whole of which time, if the ground be open, the party will be exposed to fire, and while within 200 or 300 yards of the fighting-line, under very severe fire, without any possibility of making use of cover except during halts. I think it will be agreed that six or seven such journeys are as much as can be expected of any man, considering merely the physical exertion involved. Whether any of the detachment would survive one such journey is another and important question. It must be remembered that the worse the musketry practice of the enemy the greater the danger of people moving in the open in the direct line of fire, for they will be exposed to all the ricochets and misses which pass over the probably more or less sheltered fighting-line. The dressing station will also have to be considerably pushed back to probably 4,500 or 5,000 yards, nearly three miles from the enemy's position or two and a half from the fighting-line. Even at this distance the risk of injury to wagons and teams would be very great. It is obvious then that, if the present system of lines of medical assistance is to be maintained, the labour expended on the removal of each wounded man must be greatly increased, and the cost of that removal in men and material also increased.

The question then at once arises whether the advantages to be gained by the prompt removal of the wounded are such as to counterbalance this increased difficulty of their removal during the action, or to justify the risk of increasing the number of casualties by the additional loss that will fall on the bearer personnel. These advantages consist chiefly in—(1) the possibility of rendering prompt surgical aid to the wounded in a fairly sheltered position; (2) the avoiding of the moral effect which the presence of wounded and suffering men must produce among their comrades. With regard to the first point the cases in which early treatment can be of the greatest avail are those of severe or persistent hæmorrhage. If these can be attended to *in situ*, there is no necessity for their removal to the collecting station. All cases involving fracture of bones will also probably be less harmed by being left where they lie than by being carried upwards of a mile with their fractures only roughly immobilized, not to speak of the risk they will inevitably run of receiving further injury during the process of such removal. As regards the moral effect produced on their uninjured comrades by the sight of their sufferings, this is doubtless a matter of great importance, but it is doubtful if the slow removal of the wounded, which, owing to the distance that will have to be traversed, will be inevitable, will do much to diminish this. I am of opinion that the early exhibition of some anodyne is likely to be much more efficacious. The subject is a very large one, and I can only briefly indicate the lines on which advances in battlefield arrangements must be made. These are:—

(1.) The provisions of early assistance to all wounded men *in situ* without further movement than may be necessary to afford a more easy posture, or, if there be cover close at hand, shelter from further injury. This to be furnished by the two trained men per company and the battalion medical officer working separately and taking advantage of cover. Further, every man should be instructed in the rudiments of self-help, especially in the matter of checking hæmorrhage, as an integral part of his company training, and be further instructed that when wounded it is safer for him to remain where he is than to try and make his way to the rear, where the enemy's fire is still heavy. I believe that much benefit might be found from the free use of morphia injections by medical officers under such circumstances. They not only assuage pain but allay the sensations of fear and anxiety that must assail every wounded man. For this purpose the medical officer should keep in as close touch with the fighting-line as possible, and by taking due care he need not be more exposed than any of the regimental officers.

(2.) By careful observation of the incidence of casualties during the action, and organization of a system of removal to be carried out immediately the fighting ceases. If this be done it should be possible, as soon as the action is over, to bring the wheeled transport close to the positions where the majority of casualties are likely to be found; the stretcher bearers, supplemented by fatigue parties from corps that have not actually been engaged, or are not immediately in contact with the enemy, will then be able to remove the wounded to these places with greater care than could be expected during the actual fighting. In case of reverse there should be comparatively little difficulty in these days of smokeless powder in leaving one or two field hospitals or equipped dressing stations in positions where they are not likely to be involved in a rear guard action—a mistake for combatant troops. Doubtless the position of the wounded of the beaten side must always be a painful one, but I much doubt whether their lot will not be better in future than it ever has been in the past. However little the victorious commander may care personally about their fate, the fear of contagious disease originating among them and spreading to his own wounded, not to speak of the very great power of general public opinion in these days, will, I think, incline him to take a more favourale view of their position. Mr. A. Forbes gives a theoretical view of a victorious general in the future leaving thousands of wounded uncared for on the ground. I do not think he has considered the almost certain sanitary consequence of such a neglect. Hospital gangrene, erysipelas, not to speak of cholera, enteric fever and dysentery, would probably soon change his victory into something approaching defeat, and he might find it more economical to spare a few thousand men for a few days to clear the encumbered ground than to lose their services for ever by an epidemic.

In writing this paper I have, I feel, touched on the borders merely of several important questions. I have not intended to do more than briefly indicate my own ideas on these points in the hope that others by discussing these may come to some clearer decision on them than any one person can by mere "thinking out" arrive at. This must be my apology for the somewhat sketchy nature of this paper.

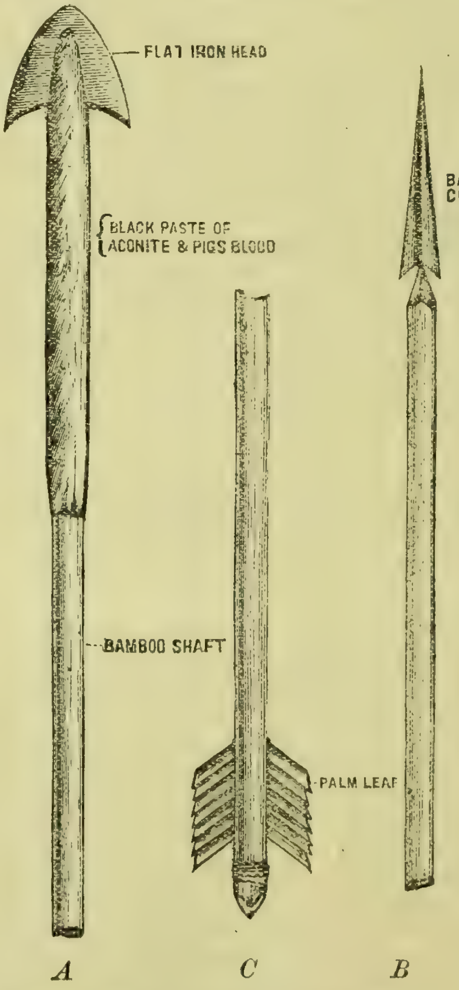
THE MEDICAL HISTORY AND EXPERIENCE OF THE ABOR EXPEDITION.

BY G. T. BIRDWOOD, B.A., M.B., B.C. (CANTAB.),
Surgeon-Lieutenant, I. M. S.

As some of you, especially those who come from the western side of India, will be in doubt who the Abor tribes are and where they live, I would first say that they are a large scattered tribe who live on our north-eastern frontier. They inhabit the Himalayan and Sub-Himalayan regions on the north-eastern border of Assam. Their villages, up in the hills, are numerous and close together, but near our frontier they are more scattered. The plains in front of the hills, where we had two or three encounters with them, are covered with thick jungle, and are well watered by three large branches of the Brahmaputra. The inhabitants are short, savage, little men, and of a Mongolian caste of countenance. Though short of stature, they are fleet of foot, and make very good *shikaris*. The spear and bow, the shield and buckler, are their weapons of defence, supplemented by a few guns, which they either steal or pick up in the way of commerce. Though barbarous in their habits, they show considerable skill in the art of war. They build excellent stockades and have a good eye for a natural position. They have a fair share of courage, though cunning and treachery, if you consent to parley with them, hold an honourable place in their code of international law. The expedition in question against them was a punitive one. They had disagreed with our political agent on various points, and instead of coming to reason they had murdered three frontier policemen and attacked others. The expedition started early in January 1894 from Sudiya (our most northern station on this frontier), and lasted for two-and-half months. I do not intend in this paper to give you statistics of killed and wounded, or percentages of sick to strength, but to give a short account of the military surgery met with, to recount two or three interesting cases, to say something about arrows and arrow-poisoning, and, finally, a few words about the transport of the sick and stores in hill country and the difficulties met with.

As regards gunshot wounds.—We had not many, for, as I have already said, the bow and arrow, the shield and spear, were their chief weapons; moreover, the few guns which were in their possession were not handled with much skill. Although frequently fired at, we only had fourteen wounded. This small number was not only due to the bad shooting, but also from the fact that the firing was done from behind stockades, through small loop holes, from which the field of vision was distinctly limited. Of the fourteen wounded, three of them died on the field, and from the rest five bullets were extracted and one arm was amputated. There was one case of a bullet wound of the face, which illustrates two or three interesting points and is worth recording. G. S. was one of a small party of Naga Hill police, who were to rush a stockade situated at the top of a steep wooded hill. About forty yards from the stockade a volley was fired at them. He was hit, and throwing up his arms he fell backwards and rolled a helpless mass down the hill, some ten yards or so. He was picked up by a comrade, apparently not much the worse. He was able to walk and was helped into camp, where I first saw him. On examination he was found to have an irregular wound, about the size of an 8-anna piece, over the left malar bone. He positively asserted that the bullet had gone into his neck, but there was no fracture of the malar or jaw bones, and nothing could be felt in the neck, nor could a probe be passed down in that direction. There was only slight tenderness in the neck, on pressure, below the angle of the jaw. I thought at the time, from the irregularity of the wound, that a stone, which the Abors often put in their guns, had hit him obliquely on the cheek and had ricocheted off. The next day, however, there was slight swelling below the angle of the jaw and more tenderness, both of which on the day after were more pronounced and accompanied also by a sense of deep fluctuation and redness, so that I thought an exploration in this region justifiable, though no bullet could still be felt. An incision was made along the anterior edge of the sterno-mastoid, and after a careful dissection down beneath the anterior edge of the muscle a sac was reached, at the bottom of which there was a bullet surrounded by a thin fluid. After a little difficulty it was extracted and was recognized at once as a Martini-Henri bullet. The wound was syringed out and antiseptically dressed. The patient ultimately recovered, though for some time he was in great danger, as erysipelas set in and caused great swelling of the throat and face. The first point of interest is the curious course taken by the bullet. After striking the malar bone, it had passed under the skin downwards across the angle of the jaw and became buried beneath the sterno-mastoid, so deep that it could not be felt. Cases are on record of bullets travelling half way round the chest just beneath the skin, but in these cases the bullets could generally be felt and cut down upon, while in this case there was no guide given as to the course taken by the bullet.

The second point of interest is why the bullet, a Martini-Henri bullet, fired at forty yards distance, did not fracture the malar bone and pulverize all before it. An examination of the bullet will here explain much, and from examination it was found that it could not have been fired from a Martini-Henri rifle but from Snider or smooth-bore, for in the first place there were no marks of rifling upon it. The calibre of a Snider (·570 inch) is greater than that of a Martini (·457 inch), so that the bullet could have come from the former and received no marks of rifling. In the second place, it had not travelled under the influence of rifling, for it had turned up on its long axis, for the facet which marked where it struck the bone was on the side of the bullet. Rotation on the long axis of a bullet, during its course, is entirely prevented by the lateral rotation of rifling. These two facts—the absence of rifling marks and the facet on the side—show that it could not have come from a Martini rifle, and it thus lacked the accuracy and penetrating power which rifling gives, and this no doubt was the reason why it did not shatter the malar bone and further penetrate the skull. A Martini bullet travels with a velocity of 1,300ft. per second, and its penetrating power would have carried all before it. The case illustrates well the great influence rifling has on the course and destructive power of bullets. Some credit, too, I think must be given to the strength and hardness of the malar bone which turned aside the bullet. It illustrates well the wonderful provision nature has made for protecting delicate structure within the orbit. Internally the walls of the orbit (lachrymal and ethmoidal plate) are of egg-shell thickness, the roof is transparent, and the floor equally thin. In strong contrast there is externally the firm bony rim which from childhood upwards receives many a blow, and the malar bone especially breaks the shock of many a fall, and in this case gave ample proof of its strength and hardness. This case, in addition to showing the curious course sometimes taken by bullets and the influence of rifling, had a further mournful interest for us; for we knew the Abors possessed no Martini-Henri rifles, nor ammunition, but we had heard rumours that one of our picquets, comprised of thirty-six men, armed with Martinis, had been attacked a few days previously and destroyed. The extraction and recognition of this bullet confirmed beyond a doubt the accuracy of this rumour, and that some of our rifles had fallen into their hands. I would now pass on to arrow wounds and the effect of their poison, which formed one of the most interesting experiences of this expedition. In the present day in dealing with tribes in Burmah and to the north of Assam arrows are weapons by no means to be despised. It is not on account of their velocity or penetrating power that they are to be feared, but because of the deadly poison that is crested on their heads, and you will understand that they are not to be despised when I tell you that men wounded in the Naga hills used to die from slight scratches within an hour. Here I have specimens of the different kinds of arrows used and a formidable weapon you will see one of them is. They are, of course, hand made, and much trouble and no little skill is expended on their manufacture; but there is not much room for their further development. There are two varieties: that with an iron head and


FLAT IRON HEAD
BLACK PASTE OF ACONITE & PIGS BLOOD
BAMBOO SHAFT
PALM LEAF
BAMBOO HEAD COVERED WITH POISON
A
C
B

Arrows used on Eastern Frontier :—
(*A*)—The Iron-headed.
(*B*)—Bamboo-headed Arrow.
(*C*)—The tail of the shaft drawn exact size from specimen.

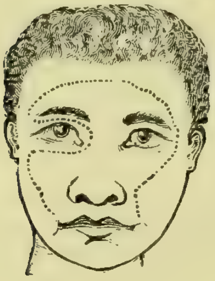
that with a bamboo head. The iron-headed arrows (fig. 1) have a flat, "broad-arrow" shaped head, about 1 inch broad, with a very sharp cutting edge. The head is fixed into the shaft by a prolongation from the base, but it is not tied or fixed firmly, in any way, but only kept in place by the spring of the wood, so that when a wound is inflicted the iron head easily becomes detached and is left in the wound for the full absorption of the poison. I had one man who was wounded close above the left breast. He removed the arrow himself. But the head of the arrow had somehow got beneath the ribs, and its extraction was a matter of no small difficulty. The poison (of which more anon) is placed on the last 2½ inches of the shaft and is carried well on to the head of the arrow. The bamboo-headed arrows are a simpler and a much lighter weapon than the former. They are not so heavy and so have less penetrating power. The head is formed by a deep groove being cut round the shaft one inch from the point. On the head thus formed the poison is thickly pasted. When, in a wound, if any lateral tension is put on the arrow, the head readily breaks off and is left in the wound. The shaft of both arrows is made of bamboo; it is about 2ft. 3in. long and a little thicker than a goose's quill. In the tail of the arrow dry firm palm-leaves take the place of feathers. About 1 inch of this feathering is found sufficient to give balance to the arrow.

Here (figs. 2 and 3) are specimens of the arrow heads with the poison on them, and in this little basket (fig. 4), also made by the Abors, you see specimens of the roots from which the poison is prepared. The roots are both aconite roots, but from two different varieties of this plant. The slightly longer shaped roots are those of *aconitum ferox*, a very deadly variety, the rounder of the two are those of *aconitum napellus* or the common aconite, from which our tincture of aconite is prepared. The *aconitum ferox* is a rare plant, and only found at altitudes over 10,000 feet. On account of its deadly properties its roots are greatly valued by the Abors, and it is of the greatest service to them in warfare and in the hunting field, and it commands a high price in their market. The preparation of the poison from either root is the same, and is as follows: Crush and powder down the root and moisten with a little water, to this add pig's blood from a freshly killed animal, and mix well till a black paste is made. In order to cause adhesion to the shaft of the arrow they dip into this paste a long thin fibre of bamboo, and when thickly coated with poison, they wind it round the shaft, starting just above the head, and the whole is then again smeared over with paste till a smooth surface is obtained.

Many have asked me what is the efficacy of this poison. There is a popular idea that it is very deadly, and in some expeditions some cases have given full ground for this belief, *e.g.*, in the Naga hills, but in this expedition something must have gone wrong with the poison, for we had seventeen wounded and only one death, and I am bound to come to the conclusion that its deadly properties were exaggerated. To make a powerful poison, I fancy the preparation is all important, and that freshness is the first essential to its efficacy. The Abors, if they intend to *shikar* big game, always prepare the poison the night before. Now, the Abors had been long expecting us, and the expedition, with the slow but certain methods of such proceedings, had been somewhat tardy in getting under weigh, and I fancy the freshly-prepared poison of the enemy had had time to get stale. Another cause of the inefficacy of the poison, perhaps, may have been that the strong *aconitum ferox* was scarce this year, and that the mild and common variety had been the only one available. Whatever the cause, we were thankful to find that each case of poisoning responded readily to the treatment given and little constitutional disturbance ever took place. The poison certainly had a bad local effect upon some wounds, for all were treated antiseptically, but many did not heal well but became red and inflamed; suppuration and sloughing occurring in the neighbourhood of some wounds. This I thought might be due to the septic material conveyed by the pig's blood with which the poison is prepared. The treatment of arrow-wounds is simple, and it should be prompt and ready. Thorough cleansing is indicated as soon as possible. The poison can be seen, in most cases, as black grains in the wounds, and if this can be washed out at once, only a small dose of poison is absorbed.

In warfare on this frontier, I strongly recommend that each medical officer and assistant should carry a small syringe in his havresack and have other syringes in reserve among the stores for cleansing of these arrow wounds. We had such on this expedition and found them most useful. Thorough cleansing is the first principle of treatment. Some local applications have been recommended, chiefly powdered ipecacuanha and liquor ammoniæ; but it is doubtful, where poison is so quickly absorbed, whether they have any real local therapeutic action. In six cases I used no local application, and they made just as good recoveries. Internal medicinal treatment is of material aid. Some cases, when wounded, showed signs of depression accompanied by cold sweating and a slow pulse. For these a mixture of digitalis, ammonia, and brandy was kept prepared. If any case got rapidly bad an injection of brandy, ℳ. xx, was given hypodermically.

Some of you will readily think that with a force of 500 or 1,000 men, armed with Martini rifles, which have a range of 2,000 yards, there is nothing to fear from men armed with arrows, which only have a range of 70 to 100 yards. If it was in the open plains these archers would indeed have small chance, but they fight in a hilly country covered with jungle, and they often find good opportunities for the use of their weapons. They form small ambuscades, hiding behind trees or rocks; or, at a sudden turn of the path, the advance guard will be met by a shower of arrows, and perhaps one or two wounded. Their assailants, to whom every path of the forest is known, vanish like deer among the trees. They too occasionally lose men at this game, but they count themselves well repaid if they can but hit one or two men, especially a *sahib*, even with a scratch, for they know then that his life hangs in the balance. As regards the swords, commonly called "*daos*," used on this frontier, they differ from the swords used on the western frontier by being straight and not curved like a sabre ; they are also much shorter, but they resemble them in having very heavy backs and remarkably sharp edges, and from their weight and keenness at close quarters they inflict very severe wounds. Most of the inhabitants are armed with them, but a few have long Thibetan swords. I had one interesting case of sword wound worth relating. The recipient was a hill coolie, with a load on his back, when the baggage guard was attacked at about 11 A.M. on January 28th. It appeared at first sight as if his whole face had been cut off. As we were on the march, and there was no time then for an operation, the flap was put in place and covered with moist boracic lint. On reaching camp at 5 P.M. a more detailed examination was made. I found the sword had hit the forehead, not far from the roots of the hair and had gone straight to the bone ; then passing downwards it had made a clean sweep of the features. The forehead, the two eyebrows, the nose, cheeks and upper lip could all be raised in one flap, and rested on my hand, attached to the face only by ½ inch of skin and flesh at the left corner of the mouth. There was a complete hole in this flap where the left eye looked out and nearly a complete hole for the right eye. On the raw surface of the face little margins of skin were left round the eyelashes and the anterior nares were apparent as two gaping holes, and the whole upper alveolar arch and gums were visible. The man was almost unconscious and the case seemed hopeless, as the wound had been received six hours previously. There was, however, I felt still, a chance. Both raw surfaces were well washed with antiseptic lotion, stray bits of dirt, flesh and skin were snipped off by scissors, and the edges then carefully adjusted all round with catgut sutures, which were at first placed far apart, and then in the intervals. Owing to the largeness of the flap and difficulty of adjustment at the internal angles of the eyes, this process took over two hours. Boracic dressing was then applied over the whole face, except the mouth, and a full dose of opium administered. We stayed in this camp a week, and the case was dressed frequently. The flap united well, except above the right eyebrow and the internal angles of the eye, from which places the pus had continually to be removed. Pus and blood also came from the nose. The patient was kept continually under the influence of opium and fed by a tube at the back of his throat. When I sent him to the base, seven days after receiving the wound, there were still some discharging points, but the flap on the whole was healing well. When I saw him two months later at the base hospital, he was as good if not a better looking man than he was formerly.

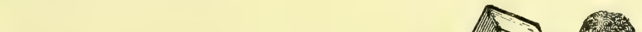


The wonderful healing power of flaps in plastic operations is well known ; but I relate this case, as I doubt if a plastic operation with such an extensive flap as this (a flap which includes nearly all the features of the face) has ever been done. It also illustrates that the flap will retain its vitality, if attached only by a small piece of flesh, for six hours at least. It also illustrates what wonderfully good surgical patients hill-men are. They are very quiet and good, and survive injuries under which Europeans would almost undoubtedly succumb.

Another of the weapons of offence used in these hills are stones, which, when handled with skill in a hilly country, become a formidable species of artillery. When the road lies through mountain passes and deep ravines, stones can be rolled down in large numbers on the force below. For this purpose they are collected on a bamboo frame-work which is made to project out at right angles to the cliff or hill which over hangs the road. At the correct moment the ropes supporting this frame-work are cut and the avalanche of stones descends on the enemy beneath. It is generally possible to wait till the avalanche has passed down and then to cross the road, but if it descends on a long laden line of coolies, some are sure to be hit. We escaped with only one fatal case, a huge stone came bounding down from crag to crag, carrying all before it. It struck an unfortunate coolie who was too plucky to drop his load and run; coolie, stone and bundle all went down the khud together. A search party was sent after him, but his injuries from stone and fall proved too severe, and he died shortly after.

Passing from weapons of offence to that of defence, you will hear, on this frontier, a lot about what are known as "pangis." These are sharp bamboo points or shafts which are stuck in the ground at an angle of about 45° to prevent advance. In and by the sides of the forest paths and before stockades, they are thickly planted, hidden in the undergrowth. They are of two or three lengths, and those who walk heedlessly may get a severe puncture either in the foot half way up the leg or in the thigh. They are sharply-pointed and made hard by slightly burning, and report says they have pierced the sole of a boot. I found the ammunition boots and putties worn by the Gurkhas were a good protection, and that the coolies who went with naked feet suffered more severely. Pangis are said to be poisoned by aconite, but I never found any poison on them. Report attributes severe complication to follow a pangi wound, but I found all such wounds (and there were many), if treated antiseptically, did well. As regards the transport of the sick in these hills, if the amount of transport available is limited or there are many wounded, there need be no fear about getting the necessary carriage. For on this frontier extemporaneous transport can readily be devised. Unlike the barren hills of the western frontier, the eastern is well wooded and numerous clusters of well preserved bamboos are met with in every village. The Gurkhas and the coolies are very skilful with their knives in splitting up bamboos and manufacturing a dandy, which, if not very strong, will last long enough to get the patient to the base. Coolies, too, especially if the paths are very steep, can be pressed into the service of transport. They are skilful in making wicker baskets known as "thâpâs," in which the patient can sit and be carried on their backs. There should be three coolies allotted to carry a heavy man, and they should be constantly changed. The "thâpâ" may be made very comfortable with a foot-rest and an awning with a cloth over it for protection from the sun. It is well to have them made according to the measurement of the patient and to see them made oneself, otherwise the coolie invariably makes them too small.

I should like to say a few words about the transport of medical stores in these hills. I would call your attention to the fact that all the transport is by hill coolies. There certainly ought to be introduced a "coolie medical pannier"—by that I mean a pannier ready fitted up and of suitable size and weight to be put on the back of a coolie. The present arrangement of bringing the mule medical panniers to the base hospital, and there transferring their contents to wooden boxes, is a very bad one. Not only do the medicine bottles get mixed up, but they also run the risks accompanying bad packing, and although the wooden boxes are labelled, confusion is apt to arise as to where any medical requisite may be found. The medical officer in an emergenecy might be unable to put his hand on what he wants, and it is even conceivable that by this delay a valuable life might be lost. If by the writing of this paper, I could get those in authority to put in hand the manufacture of "a coolie medical pannier" for use in those hills, where the transport is all by coolies, I should not consider that this paper had been written in vain. The contents of field mule medical panniers, Nos. 1 and 2, would have to be fitted into three panniers suitable in weight for a coolie (about 60lb.) to carry.



Their height should be their greatest measurement, and they should have strong leather straps at the sides (as in the diagram) for fitting over the coolie's head. Any good firm of surgical instrument makers could readily make them if he was given the leading ideas of the pannier and told for what they were wanted.

As regards sanitation, a few hints of what precautions were taken in dealing with coolies may be useful. Coolies, as a class, are dirty and unsanitary in their habits, and the precautions needed are chiefly those dictated by common sense:—

(1) In the first place, they are very prone to diarrhœa, and most of them have voracious and indiscriminate appetites. In every hill village, the pig are very numerous, and it is a wise precaution to have a control put (through the influence of the officer commanding) on the number of pig killed, the amount of pork eaten. Much of the diarrhœa I met with on these hills among the coolies was due to an excessive diet of pork.

(2) Another obvious precaution is to stop all incipient diarrhœa at once, and orders should be issued that coolies with diarrhœa to report themselves morning and evening at the hospital.

(3) Another good precaution is to have an inspection with the coolie sirdars, of coolies' kits, to see that numerous old rags are not carried in them. Such as are found to be thrown away.

(4) A fourth precaution is to have (as far as military circumstances will allow) the coolies encamped lower down stream or lower down on the hill than the rest of the force. Pollution of the water may be thus avoided.

(5) All coolies should wash themselves and their clothes as often as the camp is on a river bank.

(6) It is also a good plan to have a periodical inspection for scurvy, and any coolie with a tendency to soft or bleeding gums to come daily to the hospital for lime juice. By this means a general free issue of lime juice to all coolies will be unnecessary.

The coolie is muscularly a strong man and a good surgical patient, but to constitutional disease he readily succumbs. By these simple precautions (attention to cleanliness and incipient disease) diarrhœa, dysentery, and even cholera may be held in check, and I hope if any of you have to do duty among coolies in the upper part of Assam that you will find these hints to be of service to you.

REMARKS ON THE RECENT FIGHTING IN WAZIRISTAN.

BY SURGN. LIEUTS. H. G. MELVILLE AND B. G. SETON, I.M.S.

THE action at Wano occurred on the morning of the 3rd November before dawn. Warning had been given that there was a gathering of Mahsuds in the vicinity, who might possibly attack, and the men were roused at 4 A.M. (nothing was stirring then), and they were sitting in their tents when the first rush took place.

The enemy appear to have advanced up nullahs leading to the camp; then having assembled with complete absence of noise, they rushed on and drove in the outlying picquets. The first shot was fired at 5-15 A.M., and from that time till about 6-15 there was an uninterrupted musketry fire.

Owing to the darkness nothing could be done to recover the wounded of the regiment mostly engaged until dawn. Meanwhile, the medical officers were among the patients (all of whom had their arms in their possession), and attempted, as far as possible, to restore confidence, as well as to get rid of such Waziris as rushed the hospital itself. The enemy retired at 6-15, leaving 120 dead in camp and its neighbourhood, and all available troops went off in pursuit. Their total losses up to date of killed in action and fatally wounded are said to be over 400.

Weapons used.—A. Firearms. The enemy were largely armed with Sniders, and with their own flint lock jizails. But an unknown and probably not inconsiderable proportion of them were armed with Martinis and even express rifles.

Their firing was undoubtedly very high, but there is no doubt whatever that among the wounded officers and men in hospital the very large majority of gunshot wounds were caused by rifles at short ranges. Some of our wounded were probably hit by stray shots from our own men, but that this was only exceptional was shown by the positions of the wounds of entrance and of exit.

There was one undoubted case among the wounded, and one only of slugs having been the projectile employed, but the man who fired this did so while he was being bayonetted, and he was using an absolute smooth bore. Further proof that Martinis were used is shown in the class of holes made in the tents throughout camp.

B. Swords.—The swords used by the enemy were characteristic. They were curved, and broad, and literally razor-edged, the hilt very small, so that the grasp, though confined, must necessarily be very firm and the balance *not* near the hilt but about ⅝ up the blade. The consequence of this peculiar conformation is the clear deep cut dividing equally soft and hard tissues. They used them almost entirely for slashing, though there was one wounded man who had been undoubtedly "pointed" at and run through the chest.

C. Other Weapons.—The other weapons employed were mostly on our side. We used the bayonet freely during the attack, and in the pursuit revolvers, lances and the ordinary sword were employed.

There was no artillery fire.

Although an attack was considered to be possible rather than probable, all arrangements had been made for the reception of wounded, though no one ever suspected that such a large number of these would be brought in.

On the previous night a general service tent 160lbs. had been set apart for operations. In this tent were a portable operating table, such as is supplied to each section of a field hospital, and a heap of hospital boxes arranged to form a sufficiently convenient table ; 30 buckets of cold water were ready and into each was poured sufficient "antiseptic solution" to make a solution 1 in 2,000 of liquor hydrargyri. Arrangements had also been made for a constant supply of hot water.

In an adjoining tent the whole of the surgical instruments and appliances of two sections had been placed in case of emergency, and there was an almost unlimited supply of dressings, triangular bandages. The actual treatment of the cases is described at greater length elsewhere.

Organization, Medical, etc.—No attempt could be made during the action to give help to the fighting line, as owing to the darkness, and the fact that the hospital and Gurkha camps were more or less full of Ghazies, no unescorted doolies would ever have reached the front, even though it was only 200 yards distant. However, in a very short time after the commencement of the attack wounded men came in of themselves. As the fighting was confined to one corps, and partook largely of the nature of a "rush," there was no opportunity for regimental medical officers to give the assistance to their own corps, which they would have had there been any light. Friend could not be distinguished from foe until quite close, so that it was obviously quite hopeless to try and get the kahars to face the darkness and uncertainty with their doolies. While the attack lasted, however, all the wounded officers were brought in, some by their own men on regimental stretchers, others by the medical officers. One officer was cut down in the cavalry camp, and another close to the hospital, so that there was no difficulty in treating them at once.

The obvious fact remains, however, that it is absurd to suppose that an unarmed and essentially peace-loving man, such as a kahar, will ever be induced, in a *night* attack, to come out of his tent and man a dooly, unless each dooly is accompanied by a British officer. There ought to be far more men lent to a field hospital from native regiments, who should report themselves for ambulance duty at the commencement of an action.

These men being soldiers and armed would be of immense assistance in the recovery of wounded.

The wounded were all brought in at dawn, the enemy retiring in disorder at the same time. There was one very noticeable feature with regard to their recovery from the scene of action. Six kahars with a cumbrous dooly take much longer to fetch in a wounded man, and accomplish the work of "lifting" and "lowering" wounded with more pain to the injured man than four regimental bearers with a simple stretcher. Doolies and kahars alike are indispensable for picking up sick men on the line of march or carrying wounded men in sick convoys ; but they do not in any sense of the word fulfil the duties of a bearer company ; and when, as in this case, there are some 80 wounded men lying on the ground, with wounds of every sort and every degree of severity, the question of their speedy and *gentle* transfer to hospital is one of extreme importance, and after seeing doolies and stretchers in use for this purpose, the service ability of the latter as compared to the former is beyond question.

Dead and wounded to the number of over 125 having been collected, the task of discriminating between men who were obviously dying, and those who might recover, was speedily performed.

Tea in large quantities and hot soup made from mutton essence were ready for the wounded ; and this was given at once to the patients by the medical subordinates as they were brought in.

It was noteworthy that of all this large number of wounded only one or two had applied "first field dressings" to themselves, and it is more than doubtful if the average sepoy has the very vaguest idea why such "dressings" are issued to them. However, in the face of regulations, many men had no "dressings" in their coats at all.

The wounded complained greatly of cold; and blankets were issued to each man as he was brought in. As far as possible, as first dressings were applied, each man's wound, and the word "operation" (if such were likely to be necessary) were written on "tallies" and affixed to the patient's uniform. The value of these afterwards was very great, as when a man was asleep or unconscious, a glance at his tally showed the nature and severity of his wound.

In view of the subsequent immediate mortality, which was less than 2 per cent., and of the wonderful way in which wounded joints, etc., healed by first intention, it is worthy to note that these patients were all dressed as they lay on blood-stained ground, with their clothing for the most part soaked through, and besides these unfavorable circumstances, there was the moral effect of the extreme probability of a return by night of the enemy, and an attempted repetition of the attack. Being natives they probably felt this less than we should have done; but that they felt it to a considerable extent is undoubted.

Another interesting point is that all severely wounded men had opium given them at once in half-drachm doses of the tincture. It relieved their pain, kept them quiet, and we believe had a most important influence on the course of their convalescence.

Treatment in Hospital.—The treatment of the wounded in hospital necessarily differed from that which could be afforded in a hospital situated in a cantonment. The patients were placed on the ground on a bed of straw, on which their water-proof sheets and blankets were placed. Their bedding was practically the same as that used by them every day, being only in some few cases supplemented by the hospital blankets. The surroundings were therefore contrary to the recognized aids to keeping wounds aseptic, and when it is considered that owing to the number admitted into hospital from six to sixteen or twenty men were in each tent according to its size, the difficulties of carrying out the principles of antiseptic surgery in the field become apparent. It has also to be kept in mind that the supply of material for dressing the wounded was limited, and that the size and position of many of the wounds were sufficient to expose them to septic infection.

The hospital staff of medical subordinates and ward orderlies were most willing and energetic, and to their active co-operation it is largely due that the wounds in all cases remained "sweet"; and although in several cases pus was formed, and the wounds healed by granulation instead of by first intention, still in no case could the discharge be characterized as otherwise than "laudable," except in one case of gunshot wound of the lower jaw and mouth.

General Treatment.—As already stated the patient was removed from the dressing table to a tent, where he was placed upon his bedding on the straw-covered ground. In a number of cases it was considered advisable to keep the patient lying upon the stretcher or the hammock portion of the dooly, in which he was carried in order to prevent injury from moving him about.

In nearly all cases where there was great pain, where restlessness was likely to disturb the dressings, or where sleep was desirable but impossible to obtain otherwise, the administration of opium was resorted to—usually in the form of hypodermic injections of morpbia—but occasionally as liq. morphinœ or as pil. opii. by mouth. The dose exhibited was, roughly speaking, from one quarter grain up to one and a half grains of morphia, and with pil. opii. usually one grain repeated if necessary. In no case was an ill effect observed, and the drug was generally considered invaluable in the treatment of the wounded men.

In cases where there had been considerable loss of blood, or where shock was severe and the patient appeared weak, stimulants were given in the shape of rum, brandy, or portwine, and a generous diet with a liberal allowance of extras given, such as milk, arrowroot, soup, essence of mutton, etc. Here it may be noted that tea was found valuable, when given perfectly warm in the treatment of the shock resulting from wounds, and a drink of tea was most acceptable to many after the first dressing was over.

Warmth as far as possible was kept up. Blankets were issued and warm drinks given, but the limited amount of firewood possible to be obtained prevented any great use being made of this restorative.

In most ordinary cases a light diet was given, with milk as far as possible, and attention was paid to the condition of the bowels and bladder. Constipation resulted as a matter of course from the recumbent posture and from opium when given, so that a purgative had to be given as a rule on the second or third day.

During the day the tents were kept open to admit a constant supply of fresh air, while at night, immediatley after sundown, they were closed to prevent the chill, which instantly followed the disappearance of the sun from penetrating to the sick men.

On all occasions every effort was made to cheer and encourage the wounded, as it was noticeable that the men with the greatest pluck and spirits recovered the most rapidly.

The assurance that "the bullet was out" was seen to be a great solace to the unfortunate recipient of the wound.

Regarding temperatures, these were usually subnormal immediately after receiving the wound, but after the lapse of from three to twelve hours there was usually a rise of temperature, which lasted for from one to five or six days. The temperature was usually below 101,° but occasionally rose higher up to 104° in one or two cases. In many cases the temperature rose only at night being normal in the morning, and it was usually found on investigation that these patients had been sufferers at some time or other recently from malarial fever. The treatment adopted was that usual in fever, with quinine in cases considered to have a malarial type.

Local Treatment.—This naturally varied according as the wound was from gunshot or from sword injury. In the former the usual course of the wound was that it remained quiescent for from three to seven days, the discharge being merely oozing of blood or bloody serum, but at the end of that period, portions of bruised tissue were discharged, and the wound presented gradually a granulating appearance, forming a sinus which very slowly certainly began to fill up. In some few cases the track of the bullet had been among muscles, and was sinuous, resulting in more or less retention of discharges, which retarded healing considerably.

In the case of sword-cuts many healed by " first intention," but many others were too deep and in direction too transverse to the muscle fibre to be brought completely together, even by deep sutures. In several cases there were parallel cuts, frequently across the muscle fibres, so that considerable difficulty was experienced in the suturing of these, and it was not surprising that the stitches in these cases failed to " hold."

In the case of wounds that were not of great depth no drainage was employed, and in the majority of cases these healed up perfectly. In other cases, however, the opening of one stitch in the situation found to be most dependent relieved all tension and a cure resulted. In deeper wounds drainage was effected by drainage tubes by a strand of catgut by a thin strip of boracic lint soaked in lotion and powdered with iodoform or by simply leaving one end of the wound in the most dependent position unsutured.

In the suturing of wounds silver wire, catgut, silk and flax were employed. All were found to be valuable, and in scarcely any case was irritation set up by the stitches. The silver wire, being employed to draw together edges otherwise difficult to approximate, naturally caused greater pain than other methods of suturing, and cut through more readily. In one case a continuous wire suture was employed, and though it cut through the tissues in a portion of its extent after two or three days, still it achieved its purpose, and no gaping resulted.

The sutures of flaxen thread were very satisfactory; their only objection was that they were rather too thick to be readily threaded in needles, and in a very few cases the stitches became loosened. They were, however, very strong, were cut into regular lengths, and were readily soaked in antiseptic lotion.

The catgut and the silk supplied to the hospital were of excellent quality and proved very valuable.

The wounded were, as a rule, dressed personally by the medical officers, the senior hospital assistant however attended to a few others. The dressings were carried round by a ward orderly in the trays provided and handed to the medical officer by the hospital assistant accompanying him.

In dressing the wounds sponges were not employed, these being reserved for operations only and kept soaked in antiseptic lotion. "Swabs" of absorbent cotton wool well soaked in 1 in 2000 antiseptic solution (corrosive sublimate) were used in cleaning all wounds. In some cases the antiseptic solution was made with carbolic acid (strengths 1 in 20 and 1 in 40).

Iodoform was then well dusted over the wound and the dressings applied. The iodoform used was the crystalline powder, but this was in many cases powdered before hand in a mortar, as the crystals were rather irritating to the skin and were found also to be difficult to shake from the dredger. The powdering also economized the drug.

The dressing applied was one of boracic lint soaked previously in antiseptic solution and applied, moist absorbent wool or tow was then applied, and the whole bandaged up. Iodoform wool and carbolized tow were employed, as far as possible, and when the supply began to run short, these were put nearest the pad of lint and plain absorbent wool or tow placed outside. The one disadvantage of the iodoform wool was its tendency to break up into small pieces or to become powdery. Carbolized tow was found to be a very clean and efficient dressing, as it spread and distributed any discharge, absorbing it at the same time.

The "first field dressing," when first applied in many cases, acted so well that the wound did not require redressing for several days. It was clean and prevented hæmorrhage and the access of air in a very thorough fashion, the pad become glued to the skin all round.

A powder which was frequently employed instead of iodoform was a mixture of equal parts of powdered iodoform and boracic acid. This was quite as effective and apparently more economical than iodoform alone.

On slight superficial abrasions or wounds powdered boracic acid and arrowroot was found valuable when healing was in progress. Zinc oxide and arrowroot were used for the same purpose.

The bandages used were triangular ones and roller bandages. Both were equally widely employed. The stiff calico bandages were rather difficult to apply at first to dressings, but after being washed became much softer. Owing to the great number of wounds requiring dressing, it was absolutely necessary to have bandages washed—a service which was performed by the hospital washermen daily.

Adhesive plaster was used to keep on pads or dressing where there was a danger of the patient, through restlessness, disturbing them. The plaster was also employed in making extension, though it was somewhat narrow for that purpose. It was not used to bring together the edges of wounds, except in one or two cases of comparatively trifling injury.

The amount of material for dressing cases was certainly limited in quantity, but it was calculated that with the amount at disposal, three more such engagements could be undertaken by the field hospitals. This was almost entirely due to four "reserve boxes" stocked with these things, which had been brought up by the directions of the principal medical officer of the escort. The chances for each individual patient would have been much less, had it not been for the forethought exercised in providing these boxes of reserve dressing material. As it was, although economy had to be rigidly observed, there was no actual lack of material.

Dressing and operating Tents and Operations.—The tents for dressing and operating were laid out the night before the attack in anticipation of a number of casualties. For this purpose two general service tents (100lbs.) were set aside.

In one a table or shelf was made down one side by means of two rows of two medical boxes, one above another, covered with turpaulins. On this table were placed dressings, antiseptics, chloroform, instruments, splints, ligatures, and bandages. Hypodermic syringes, morphia and stimulants were placed on an office table in the tent, and additional table accommodation was afforded by utilizing one or two operating tables, on which field medical cempanions and field surgical havresacks were laid out open and ready for use. Water for drinking purposes was also laid ready in *chaguls* for the wounded.

The result of this preparation was that in performing the first dressings of the wounded, every thing requisite was at hand, and no time was lost. In addition in very many cases the first dressing hurried, though it was sufficient, and no further dressing was required for two or three days,

In the other tent two tables for operating were placed, the operating tables supplied to the hospital having become broken and unsteady, owing to the extreme dryness of the climate and the necessary rough treatment to which camel carriage subjects every thing. Only one operating table was used, and another was improvised with field medical boxes covered with tarpaulins. This formed an admirable substitute, being very steady and of just a suitable breadth and height. The breadth was the length of each box, and the height that of two boxes placed one on the other. The length of the table so formed was about 6½ feet. Over the tarpaulins were placed two blankets and over the blankets a waterproof sheet.

Across the tent in the middle was placed a table with instruments and ligatures, dressing trays, and basins for lotions were laid ready on the floor.

The dressing of the wounded occupied the staff from dawn to about 10-30 A.M ; at which time a halt was made to enable every one to get breakfast. Notice was sent to medical officers of corps units that at 11 o'clock operations and complete dressing would be begun.

Accordingly, at that hour those wounded men whose cases demanded further attention than could be given in a rapidly executed first dressing, were brought in and chloroformed. The chloroform was administered on a towel folded and held over the patient's face and under his chin, leaving the face to the view of the chloroformist. Anæsthetizatlion was generally rapid. It was, stopped before the dressings were applied ; and when the patient began to show signs of returning animation, a hypodermic injection of morphia was administered equal to from ½ to 1 grain morph. hydrochloratis.

The patient was then removed, and the next man brought to the table. A ward orderly was detailed to watch the man removed from the operating tent until he fell into a natural slumber.

In all cases antiseptics were employed. The antiseptic used was corrosive sublimate, strength 1 in 4,000. It was made from the bottles of antiseptic solution supplied in the field medical boxes. The concentrated solution was diluted and placed in buckets outside the operating tent before the hour fixed for commencement of work. As required it was poured into basins for use.

In all cases where it could be employed the principle of bloodless surgery was adopted before dressing or operating for wounds on the limbs. The limb was elevated, and, if possible, an elastic bandage applied from the distal extremity. An elastic cord tourniquet was then applied to compress the main vessels. In several cases it was thought advisable to use a screw tourniquet to prevent reactionary hæmorrhage. This was applied loosely, but the medical subordinate detailed to watch over such cases was directed to tighten the screw whenever any symptoms of hæmorrhage appeared. Thanks, however, to elevation of the limb and firm bandaging, there was very little necessity to use this measure.

No ill effects were observed from the use of chloroform. Insensibility was rapid as a rule, and in only one or two cases was there any tendency to vomiting, and that was always checked by the further administration of the anæsthetic.

These good effects may possibly have been due to the naturally temperate life of the native, and to the fact that no food had been taken since the evening meal of the previous day. Recovery from the anæsthetic was also very seldom delayed for many minutes after its administration ceased.

The use of morphia also produced no bad effects. The pain and restlessness following on an operation was obviated, and in consequence the dressings were not disturbed by the patient. The small amount of reactionary hæmorrhage may have been due to some extent to the use of this drug. The patient usually fell into a sound sleep after the operation. This sleep varied greatly in its duration. Frequently the wounded man did not regain complete consciousness until the following morning, but if his sleep was short and lasted for a few hours only, he remained perfectly quiet, and stated that he felt quite comfortable.

Beginning at 11 A.M. the work of attending to the wounded was not ended, even when darkness supervened, and the dinner hour was long past before the staff of the field hospitals assembled to do justice to it.

During the long day's work the hospital staff had been ably assisted by the P. M. O. and some of the medical officers in charge of corps units, and these spared no pains to help in the work of relieving the sufferers.

The wounded of our own side were not the only ones treated in the hospital, almost equal care and attention was bestowed on such wounded Waziris as were brought in for surgical aid, and these big brave fellows who never flinched or moved a muscle in spite of their sufferings were placed together in a tent set apart for them, and hospital blankets and "medical comforts" issued to them.

The hospital assistants and also the ward orderlies worked most energetically and efficiently. It required an order to induce them to leave their posts to get some food, which they did by turns. Their assistance was of the utmost value throughout.

The tables and the preceding description show the results from the surgical point of view of the engagement at Wano. The successes have vastly exceeded our anticipation, and many cases, though doomed to come before the invaliding board, will doubtless live a useful civil life.

The enormous casualties in one regiment as compared with the other regiments present show that, as far as that particular regiment was concerned, a true regimental system must have failed, had there been no field hospitals. But a repetition of the engagement at Wano could scarcely occur; and had the total wounded been spread more or less evenly over all the "units" present a regimental system would have answered just as well as the field hospitals. This, however, is not the occasion to enter into a discussion on the relative merits of the two systems. In this case, the work fell upon the field hospitals, and it was done with a measure of success alike surprising and gratifying to all concerned.

Table 1.—Total Losses.

	British Officers.	N. O.'s and Men.	Public and Private Followers.
1. Killed ...	1	20	24
2. Wounded ..	6	46	24
3. Died subsequently	1	1	1

Table 2.—Wounded.

	Sword Cut.	Rifle, Pistol or smaller shot.
1. British Officer ...	2	4
2. Native Officers & Men	33	11
3. Followers ...	19	5

Table 3.—Classified Return of Wounds.

Native Officers, N. C. O.'s & Men.	Total Wounded.	Weapon or Projectile.	
		Sword.	Gunshot.
1. Wounds of Head ..	14	12	2
2 Wounds of Face ...	5	2	3
3. Wounds of Chest ...	4	1	3
4. Wounds of Abdomen ..	1	...	1
5. Wounds of Back and Spine ...	1	1	...
6. Wounds of Upper Extremities	11	8	3
7. Wounds of Lower Extremities .	6	6	...
8. Wounds with direct penetration or perforation of large joints.	4	3	1
TOTAL ...	46	33	13
FOLLOWERS.			
1. Wounds of Chest ...	2	1	1
2. Wounds of Abdomen ...	2	...	2
3. Wounds of Back and Spine ...	3	3	...
4. Wounds of Upper Extremities	9	9	...
5. Wounds of Lower Extremities...	3	2	2
6. Wounds of Large Joints ...	4	4	...
TOTAL ..	24	19	5
BRITISH OFFICERS.			
1. Wounds of Chest	1	...	1
2. Wounds of Upper Extremities	3	2	1
3. Wounds of Lower Extremities...	2	...	2
TOTAL ...	6	2	4

Table 4.—Killed in Action.

	British Officers.	Native Offrs. N. C. O.'s and Men.	Followers.	Total.
1. Sword Cuts ...	1	8	12	21
2. Gunshot ...	...	12	12	24

DISCUSSION.

Surgeon-Colonel R. Harvey said the paper was most interesting and shewed results which were very gratifying: not, he thought, altogether surprising, for the country was high, bare, and thinly populated; so that the water-supply was not, as a rule, liable to be defiled, and pure air, pure water, and the provision of all the necessaries for proper surgical treatment, with ample supply of food, shelter, and firewood, put the men under the best possible conditions for recovery. The medical results of this campaign were not yet available, but in the Second Miranzai Expedition of 1891, under somewhat similar conditions, excellent results were obtained.

Of 73 wounded men, 6 of whom were shot through the lungs, only two died, both lung cases. All the others made excellent recoveries and for the first time on record the losses at the hands of the enemy were greater than those from disease. The death-rates were about half what they would have been had the troops been doing nothing in cantonments.

THE EFFECT OF THE MAGAZINE BULLET IN WAR.

BY ANDREW DUNCAN,
Surgeon-Major, I. M. S.

ALTHOUGH I have had personally no experience of the wounds caused by the Magazine bullet, yet I thought a *resumé* of such facts, as have been gained by the experience of others, might be acceptable to the members of this section, and might elicit some valuable data from those amongst us who have been more fortunate in this respect than myself. Now the results caused by the impact of the new bullet have so far been only shewn in the Chilian War, where the Männlicher rifle was used, and in the wounds caused during the late Bombay riots, and in some other accidental cases, and in some riots in the Continent.

The following are the chief physical characters of the bullets in use by some of the European armies at the present day :—

	Calibre.	Weight.	Muzzle Velocity.
Germany ...	0·310″	223 grs.	2,034 ft. per sec.
France ...	0·315″	216 „	2,073 „ „
Austria ...	0·315″	242 „	1,968 „ „
Russia ...	0·300″	215 „	2,034 „ „
England ...	0·303″	215 „	2,000 „ „

In the remarks which follow on the physical characters of the bullet, I am much indebted to a valuable paper by Surgeon-Captain T. A. Perry Marsh, A.M.S., published in the "Journal of the Royal United Service Institution" for November 1891—a paper which will well repay perusal.

The physical effects of the bullet, which are of chief importance, depend principally on—

(1) the weight,
(2) the diameter,
(3) the composition,

whilst a few words may be said on—

(4) the velocity.

Taking more especially our own missile, we find that the Martini-Henry bullet weighs 46 grains more than the Lee-Metford. The effect of this declared *weight* means a loss of stopping power of the bullet, and less shock to the man struck. The *lessened diameter* again will, of necessity, decrease the size of the wounded area. In the soft tissues, the track will be so narrow that practically there will be no destruction of tissue in its course. Compare this with the terrible wound inflicted by the Snider bullet. This, which may be considered as practically an explosive bullet, leaves behind it great destruction of the soft tissues. A Lee-Metford bullet could perchance part between the bones of the forearm without injuring either. Not so with the Snider or Martini-Henry. Thus, although the new bullet has far greater penetrating power, yet there is at the same time much less destructive effect. With regard to the *composition*, again, the missile, as is known, consists of a core of lead and antimony encased in a hard inelastic metallic case of nickel and copper. This will effectually abolish all the effects produced by the splintering up of such bullets as the Snider.

Amongst other physical properties of the bullet may be considered the *velocity*. The higher rate of velocity will drive the bullet further, and thus it may penetrate several men, and should it strike a long bone at close ranges, more extensive splintering will take place than with the bullets of lower velocity.

So much, therefore, for the theoretical part of the question. Let us now consider the results gained from experiments. And first I draw attention to some important experiments carried out on living horses by Surgeon-Major Habart in Austria, up to a zone of 400 metres; he found the effects compared with those of the old leaden bullet to be not so great. Similarly up to a zone of 800 metres, especially with regard to the bones up to 1,200 metres, there was still less comminution and fissuring. The shape of the projectile again was not, as a rule, affected up to 200 metres, the bullet was never found to have lodged in the body. Foreign bodies, on the other hand, were more frequently met with, such as bits of clothing, etc. Chawel and Bruns obtained much the same results. However, the most elaborate experiments have been carried out by Dr. Demosthen, of Bucharest, with the new Roumanian Männlicher. Dr. Demosthen points out that, in all preceding experiments, a source of error has crept in, namely, that they were carried out with *reduced charges* at *constant distances*, whereas in war the wounds inflicted will be *from fully-charged cartridges* at *varying distances.* The weapon now was tested under conditions obtaining in actual warfare.

The following were the experiments :—

(1) Firing at metal plates, trees, saw-dust, etc.
(2) Firing at fully-clothed human cadavers at distances from 50 to 1,400 metres.
(3) Firing at living horses from 5 to 1,400 metres.

The first set of experiments need not detain us here. With regard to the result on human cadavers and on living horses, after each experiment the bodies were carefully examined at the author's laboratory and at the veterinary school. The injuries classified according to regions, as far as the cadavers were concerned, were as follows:—

Skull (all with lesions of the brain)...	5
Face	5
Neck	1
Face and neck	1
Thorax	4
Abdomen	5
Thorax and abdomen	1
Shoulder	1
Arm	4
Forearm	3
Hand	2
Thigh	8
Knee	1
Leg	7

Lesions of the limbs, especially the lower, were the most frequent. The principal features of the wounds were as follows :—

The apertures of entry and exit were usually round and smaller than the calibre of the bullet, especially at the longer distances, but may vary, that of the exit being most variable. This margin, especially that of entry, showed an areola due to loss of epidermic tissue. Fibrous aponeuroses, ligaments, tendon, and stretched muscles shewed elliptical perforation, parallel to their fibres. With regard to the bones, the aperture of exit and the muscles posterior to the point of fracture are lacerated, and more or less destroyed. The spongy bones, at short ranges, were fractured : at long distances, were more regularly perforated. As regards the skull, at long and short distances, the injuries are about identical. None of them showed the more or less regular circular apertures without fractures described by Habart and Bruns, the result of experiments with reduced charges at constant distances. With regard to the flat bones, perforation without fracture only were found beyond 600 metres.

As regards the diaphyses of the long bones, comminuted fractures with solution of continuity were found in about an equal proportion for all distances. This, again, does not agree with the result of Bruns and Habart, who found that up to 1,200 metres there was clean perforation without solution of continuity. The same results obtained in the epiphyses, at any rate, up to 600 metres. Thus we see the general result consisted in *perforation* always accompanied by *comminution* and *splintering*.

With regard to the viscera, Demosthen's result in the living horse shewed extensive loss of substance with laceration in the heart and large blood vessels. The medium and small vessels shewed clean and well-defined injuries. In all hæmorrhage was marked and was sometimes rapidly fatal.

The stomach and intestines shewed frequent perforation with more or less regular lesions, or extensive loss of substance, according to their empty or full state.

Liver and spleen wounds were not extensive. The meninges were extensively lacerated. The brain and spinal cord were tunnelled, and the brain guttered with lodged splinters of bone.

The power of penetration was shewn by placing five cadavers behind one another at intervals of 50 centimeters. At a distance of 600 metres the bullet traversed three bodies, perforating the tibia in each instance.

With regard again to the modern projectiles never remaining behind in the wound, Dr. Demosthen is opposed to the view, and instances three bullets removed from horse shewing alteration in shape.

We now come back to the experience gained in actual war and in accidental cases:—

In the Chilian war the Männlicher rifle was used. Here it was found that the wounds did not retain any portions of the projectile, and that they healed without suppuration in five to ten days. The diaphyses showed much splintering, and healing was slow and difficult. In only one case was a simple perforation found. Explosive effects were observed in one case, where the epiphysis was damaged at short range. With regard to penetrating wounds of the thorax the bullet occasionally remained encysted in the lung without causing abscess or purulent pleurisy.

In Biala, in 1890, where the troops armed with the Männlicher fired on the crowd at from 40 to 180 paces, according to Bogdanik some of the wounds were reported on as frightful.

In the Bombay riots, in 1893, in case of wound of the lower extremity from the Lee-Metford, the bones were found shattered from knee to ankle, necessitating, as the only resource, amputation.

Mr. Bone reports a case in which the bullet passed through the head of the tibia, completely breaking up the cancellous tissue and opening the knee joint, with a fatal result. In a second case the humerus was fractured transversely, the ends were very irregular, but not much comminuted. In a third case the infraspinous fossa of the scapula was fractured into four fragments. In a fourth case the heads of four metatarsal bones were broken, with the bullet embedded in two of them. In all the cases the absence of shock was especially noticeable.

In a case reported by Brigade-Surgeon Lieutenant. Colonel Stevenson all the astragalus, with the exception of its head, was pulverized, and all its articular surfaces split, excepting that with the scaphoid. The lower end of the tibia was extensively fissured, and to a certain extent pulverized.

So much then for the results produced by the new Magazine bullet. I will now conclude this short *resumé* by a few remarks on the prognosis of the wounds.

The danger arising from hæmorrhage will, on account of the clean-cut nature of the wounds produced in the blood vessels, be much greater than heretofore. Many more will die on the battle-field. Injuries to the limbs will not often be amenable to conservative surgery on account of the more extensive lesions produced in the bones.

As regards the personnel of the medical staff, the moveable field hospital accommodation must be increased, and there will have to be an increased number of bearer companies. The evacuation of the wounded from front to rear will not be so prominent a feature as heretofore. We should rather aim at bringing the hospitals up to the wounded than taking the wounded back to the hospital; for, as Surgeon Captain Perry Marsh rightly remarks, inasmuch as there will be a larger number of wounded and of these a great proportion of comparatively slight injuries, satisfactory result can only be attained by at once bringing the wounded under treatment, and this treatment must be set in hand at once. Hurriedly directing the wounded from the front to the rear will not cause satisfactory results.

But it has been held, on the other hand, and rightly too, I think, by Surgeon-General Bardeleben of the German Army, that an increase of bearers will simply increase the number of the wounded. It would seem that it will not be possible to carry away the wounded during the battle; for, as Mr. Forbes has pointed out, the first battle will wipe away the bearer organization carried on under fire. The late Professor Billroth also held that it will be no longer possible to remove the wounded from the battle-field during the battle by means of bearers, since every man of them would be shot down as bearers, and would be more exposed than the men in the fighting-line. The most that can be aimed at is that the wounded man of the future be attended to within twenty-four hours.

Bearing all these points in mind, *viz.*, the far-reaching character of the bullets, the extensive lesions of the bones, and the more frequent cases of immediate death from hæmorrhage, I fully agree with Dr. Demosthen, who thinks that the introduction of the Magazine bullet is anything but a distinct gain to humanity.

DISCUSSION.

Surgeon-Colonel Cuffe, C. B., A. M. S., said that the practical point for consideration in this interesting paper seemed to him to be the means to be adopted for removing the wounded. It was stated that about 20 per cent. of the force in action might be estimated as the probable number of killed and wounded. It would very likely be considerably more.

The system in India, by which reliance was placed for first aid on the personnel of the field, supplemented by two or more trained men from each company, would not suffice for the wants of modern war. In the first place, the generals would not allow such a large number of men to be detached from the fighting line and the services of the personnel of the field hospital might not be available when required, as the wounded or other patients in hospital would probably require the services of all the hospital establishment.

He saw no other way out of the difficulty than to establish in India regular bearer companies, both of Europeans and Natives. These being thoroughly trained and organised in first aid, should follow up the fighting line as close as possible, and should remove the wounded as rapidly as possible to the collecting and dressing stations, and thence to the field hospitals.

THE EFFECTS OF BULLETS OF SMALL CALIBRE.

BY L. W. SWABEY,

Surgeon-Major, A. M. S.

There is so little known at present of the nature of wounds inflicted by rifle bullets of small calibre that any contribution on the subject, however meagre, may, I hope, be of some interest to army surgeons. I have only seen three cases during my service:—

1st Case.—A party of recruits were firing on the range at Aldershot in February 1890. A workman was engaged in filling a cart with sand at what was computed to be 1½ miles from the firing point, when he felt a sharp stinging pain in the right thigh. He slipped off the trousers' leg and saw a small hole in his thigh, from which the blood was slowly oozing. On examination, I found a circular hole almost exactly corresponding in size with the diameter of the Lee-Metford bullet at the lower and outer part of Scarpas triangle. On turning the man over, a small slit of between a ⅛th and a ¼th of an inch in length was seen exactly in the fold of the buttock near the centre, the bullet appearing to have passed almost directly backwards without injury to bone or femoral or profunda femoris.

Very slight hæmorrhage was occurring from both wounds, showing that no important vessel had been severed, and the bone did not appear to be injured, as the man had walked since the injury without much trouble. There was no shock of any kind, and the pulse was good, and he conversed freely in an ordinary tone. I put an antiseptic pad on both wounds, with a bandage over all. In a few days I left for India, but I heard that the man recovered without a bad symptom in three weeks, everything going on perfectly well, and the wound healing without suppuration of any importance.

The corduroy trousers showed exactly corresponding apertures to those on the limb. The bullet was found on the ground about two yards behind the injured man. It and its casing were quite intact. The case is instructive as showing the great penetrative power of these missiles at long ranges; the very small aperture of wounds of entrance and exit, judging from the quick recovery; the small injury done to soft parts, the bullet appearing to cut clean through them; the almost complete absence of shock and the very slight hæmorrhage were noticeable.

2nd Case. —Private M. F——,——th Regiment, age 24, perforating wound of chest, (*i.e.*) gunshot (thorax), homicidal; bullet, Lee-Metford rifle.

On 17th June 1894, between 12 and 1 in the morning, I was called to the station hospital to see Private M. F—, who was said to have been shot by a comrade in the fort. He had been placed on a bed cot and was lying on his back. He was suffering from severe shock, with pallid countenance, and dilated pupils, and weak fluttering pulse. He was conscious but moaning loudly, and complained of considerable pain in the right side. On examination I found a small punched-out hole close up to the spinous process of the second dorsal vertebræ. There were no marks of powder about the edges of the wound, which appeared to correspond in diameter with that of the Lee-Metford bullet. There was no protrusion of clot, and no contusion of the edges of the wound. In a line drawn from the centre of axilla between sixth and seventh ribs was a similar aperture to the one above described, which proved to be the wound of exit. Slight hæmorrhage was going on from this latter wound, the blood being of bright, scarlet colour, and trickling down the walls of the chest with each expiration. The bleeding was controlled by a pad of antiseptic wool and a bandage. At 9 o'clock he was removed in his bed to a special ward and the hæmorrhage recurred. This time it was more profuse, and was controlled after some trouble by pressure and subcutaneous injection of ergotine. His temperature rose to 101° the first evening after the occurrence, but there was no cough, and the pain was less.

To make it plain how this unusual injury was inflicted it will be necessary to give a short history of the affair.

Private F— appears to have been lying asleep on his cot in the guard room of the fort, with his head within a yard of the open door. He was lying on his right side. Private C—, who was on sentry go, came round to the back of the guard room, put the muzzle of his Lee-Metford close to Private F—'s neck and fired. Private F— had his coat on at the time, and it was ignited by explosion. He obtained assistance and was sent to hospital in a *doolie* without his coat, which I afterwards saw. The part of it corresponding to the wound of entrance was burnt and charred, but there was a small hole in the side, corresponding to the wound of exit. I examined the locality of the affair with the following result: I found that the bullet, having passed from above downwards and outwards, after perforating the thorax, had passed through the mattress which is stuffed with cocoanut coir, had continued on through the deal board of the cot, and then struck the red brick floor, which it grooved deeply, and then ricochetted upwards, and lodged under the ledge of the dining table, where it imbedded itself transversely. The bullet when extracted was very much bent and twisted, and on one surface were some marks of the red brick. The apex of the bullet could be made out tilted to one side. The nickel case had almost entirely disappeared. In this case there was a large resultant empyema, which was treated by free drainage, by means of a tube introduced near the wound of exit. The wound of entrance healed readily. The empyema has now nearly disappeared, and the formerly bulging intercostal spaces have fallen in. The patient is very much emaciated and has slight fever in the evening. The temperature generally falls to normal in the morning. It is going on as well as can be expected, and I hope will eventually recover, but of course with very much damaged health. The course of the bullet downwards and outwards fortunately avoiding all large vessels, and passing as it must have done through the greater part of the longitudinal axis of the lung, gives rise to the thought of what would have happened had the bullet been a Martini-Henri, or a Snider. Some time ago I saw a note in one of the English service papers purporting to come from the principal medical officer of the Chilian army, in which he stated that whereas formerly mortality of lung wounds was nine out of ten, that now, in the recent Chilian war, the mortality was only one in ten. This seems quite likely, if one can judge at all from my case, as the patient has survived notwithstanding that a much larger tract of lung was injured than would be at all likely in war.

3rd Case.—Private C——, ——th Regiment, age 25, wound, upper extremity, gunshot; left arm, self-inflicted; bullet, Lee-Metford rifle.

Private C—— was brought to hospital on a stretcher, between 12 and 1 o'clock on the morning of 17th June 1894. Instantly after shooting Private F——, alluded to in preceding case, Private C—had attempted suicide, by grasping the muzzle of his rifle with the left hand, and pulling the trigger with the right thumb. He attempted to shoot himself through the chest, but if the experiment be tried with an empty rifle, it will be seen that this is well nigh impossible, as the rifle is too long, and in this case the bayonet was fixed. I found him on a hospital bed lying on his back, the pulse at the left wrist was almost imperceptible, but was stronger at the right. He was suffering considerably from shock and loss of blood; the face was pallid, pupils dilated, an expression of intense anxiety, and he was moaning loudly. On examination I found a jagged, irregular wound, 1 inch long, ½ inch in breadth at the junction of the upper and middle thirds of the left arm, almost exactly in the course of the brachial vessels. The edges of the wound were contused, and the surrounding skin scorched and blackened by the explosion. The wound was filled by clot. Above the wound was an improvised tourniquet which had been put on at the time of the occurrence by the fort hospital assistant. This was removed without any recurrence of arterial hæmorrhage. On the posterior aspect of the arm was found a very small punched-out hole, with clean cut edges, corresponding with diameter of Lee-Metford bullet.

The direction of the tract of the bullet was downwards and backwards, behind the shaft of the humerus, the lower opening being as nearly as possible in the centre of the beginning of the triceps aponeurosis, 1½ inches below the wound of entrance, and four inches above the tip of olecranon.

Treatment.—Both wounds were dusted with iodoform and enveloped in boric wool and carbolised tow, with bandage over all. Hot-water bottles were placed to the feet and some small amount of brandy administered during the shock, which passed off in two hours. At 7 A.M. he was doing well. The affected limb was somewhat colder than its fellow. The temperature of the body was normal. About noon I found that considerable hæmorrhage had taken place through the dressings. A tourniquet was placed above wound of entrance, and when this was loosened the blood spouted out in two or three arterial jets. The limb below the tourniquet was very tense, swollen, and discolored, and the forearm was very cold. I decided to tie the brachial artery at once. The patient having been placed under chloroform, I made an incision about an inch in length from above downwards, through the superficial structures which joined the upper border of the wound, and another incision, about ½ an inch long, downwards, from the lower border of the wound. The wound of entrance having been enlarged, and a large clot removed, the tourniquet was loosened, some small vessels secured, the bleeding point of the superior profunda was then seen, the vessel having been completely severed about ⅛th of an inch from its origin from the brachial artery. Nothing was seen of the distal end of the artery. A carbolized silk ligature was now placed round the brachial, just above the origin of the superior profunda. The incision exposed a large cavity, and the muscles were considerably torn and lacerated as a result of the explosion.

The bone appeared to be untouched. During the operation nothing was seen of the large nerves, which must have been lacerated by the explosion.

The wound of exit was injected with carbolic solution (1 in 40), and the tourniquet was loosened, and the wound being treated antiseptically was allowed to granulate.

Next day the collateral circulation being established the pulse was quite perceptible at the injured wrist. Four days after operation the pulse was comparatively strong. The wounds of entrance and exit completely healed in about five weeks, and he was discharged to cells on the 10th October 1894. The following is the present condition of arm: Old wounds completely healed, arm considerably emaciated, especially loss of muscle on posterior surface of forearm.

Partial loss of sensation, more particularly over inner side of arm. Partial paralysis of flexors, the index finger being almost perfectly straight. The arm will probably be almost useless for the future. The curious point about this case was the escape of the humerus and brachial artery from the result of the explosion, and the small wound of exit. In all the above cases black powder was used.

It is impossible to class the effects of these bullets together, as experiments seem to prove that the wounds produced by the German rifle are of a very different character to those inflicted by the French Lebel, or the English Lee-Metford rifles.

When the new English rifle was first tried on animals, it was found that it frequently had an explosive effect, which was caused apparently by the bullet passing through the casing. A harder casing was adopted with the result that, as far as soft parts are concerned, the bullet appears now to merely cut a clean tract through the tissues. The bullet cases of the Lee-Metford sporting carbine are slit in three places over the bullet, the result being that when the bullet strikes an object, the case expands, and there is a terrible wound inflicted.

In an article by Veterinary Captain F. Smith, Army Veterinary Department, in the January number of the "Journal of the Royal United Service Institution," there are some very instructive experiments recorded on bones of animals with the Lee-Metford rifle.

The result of Veterinary Captain Smith's investigations are—

(1) That bullets at a high rate of velocity have a most disastrous effect on the shafts of long bones. Bullets striking these bones at from 50 to 200 yards simply disorganized the bone, instances being recorded of a bullet striking the centre of the shaft of the tibia and practically leaving nothing of the bone intact but the upper and lower extremities. In flat bones, such as the scapula, where there is very little resistance, a hole about the size of the bullet is sometimes made, with very little accompanying splintering. The effects of the extremities of long bones is not so wide spread; the cancellous tissue predominating, and resistance being so diminished, there is not such a tendency to splintering, but the cavities made by the bullet are filled with bone dust.

(2) Bullets fired at longer ranges (300 to 1,000 yards) are less destructive to shafts of long bones, the amount of splintering observed decreasing with the length of the ranges. Bones of tarsus are not so pulverized as they are at short range, the "zone explosif" of the French. Surgeon-Captain Smith seems to agree with other observers that the ·303 bullet, of the calibre of a lead pencil, is much less destructive to soft parts than the Martini or Snider bullets.

The French now use the Lebel rifle with a projectile of 8 millimeters with an outer casing of hard metal. This rifle has succeeded the Gras rifle with a projectile of 11 millimetres. Professor Delorme has discovered that the explosive effect with the Lebel rifle is noted up to 300 yards, and he says that the increased hardness of the casing does *not* materially diminish the destructive effects on hard bones at any range. He says that, owing to the small size of the bullet, wounds of soft parts readily heal.

I am not aware of the nature of the casing, but it is in all probability of a softer material than the German bullet, which is of steel.

For all practical purposes I think we may class together the effects of the English and French bullets, but the Germans have a different story to tell about their rifle.

In a lecture at Spandau, on 2nd April 1892, Captain v. Heyking, of the School of Musketry, showed how the steel coating had increased the penetration of the 8-millemetre bullet of the German rifle. With regard to the experiences of the recent Chilian war, Captain v. Heyking maintains in spite of the assertion of a high Chilian officer, that the proportion of killed to wounded, as regards the small bore Männlicher rifle, was, as 4 to 1, that the reverse is the case.

He referred to the testimony of an expert, who, in his report, states : "There is a small proportion of mortally wounded, the wounds caused by the Männlicher are of quite an exceptional nature, they either kill the man outright, or else ensure recovery, free from complications."

"The bones were *clean pierced*, even at the greatest distances, without leaving splinters of lead or steel. The bullets, after extraction, had maintained their orginal shape"

Professor Brun's (Belgian) experiments with the Manser rifle show that the bullet generally pierces bones at all ranges with little splintering.

The Austrian Army Surgeon, Doctor Habart, arrives at similar conclusions as to the humane character of the weapon adopted by his country.

I do not think that any thing is known as yet of the Magazine rifle about to be adopted by the Russians.

I think the lessons we may draw from the effects of the Magazine rifle bullets, as far as they are known, are :—

(1) The necessity of increasing the personnel and material of the ambulance and transport service, as with the increased expenditure of ammunition, and the great velocity of the bullets, we may anticipate that the number of wounded will be largely increased, some of the small calibre bullets being able to piece four to five men at 100 yards.

(2) The prognosis in wounds of lung and muscle will be better, as these parts offering but little resistance, the bullets will pass clean through the parts without much accompanying destruction of tissue.

(3) The necessity of careful exploration of bones that may be injured, the wounds of entrance and exit affording no clue to the extent of the injury.

(4) Exploration for discovery of lodged bullets will be nearly a thing of the past, the velocity being so great that bullets will almost certainly pass through any part hit at any range at which the rifle will be used.

(5) The hæmorrhage from cut vessels and injuries to important nerve trunks will probably be relatively diminished owing to the small size of the projectile.

(6) Laparotomy will probably be more often practised and with better success than heretofore owing to the small size of the aperture which will generally be made in the coils of intestine.

(7) Shock will be lessened in injuries to lung and soft parts.

(8) In wounds from German or Austrian rifles we may expect penetration of bones without explosive effects and the prognosis in case of these wounds will be more favourable than in those inflicted by French and English rifles.

Of course at any day a steel casing may be adopted for the bullets by the English and French Governments which will probably render their rifles more humane.

NOTES ON A CASE OF GUNSHOT WOUND.

BY D. C. CRAWFORD, M.B.,
Surgeon-Major, I. M. S.

H. C., European male, aged 23, went out shooting ortolans at Purnea on 16th March 1890, driving out from the station in a dog-cart. He had just got out of the trap, and was stooping down, when he dropped his gun. The trigger struck one of the spokes of the wheel, broke, and the gun went off, the charge striking him on the right side of the abdomen. The gun, a breechloader, was loaded with No. 8 shot, and was not at full cock when it went off. He did not become unconscious, and was brought into the station, a distance of about two miles, in the same dog-cart. On his arrival he was seen and treated by Dr. Picachy during my temporary absence from the station. He had a circular wound on the right side of the abdomen, in the right anterior axillary line, 2 inches below the margin of the ribs. This wound, 2 inches in diameter, did not penetrate the abdominal cavity, but passed upwards and backwards to the wound of exit. This latter wound was in the right posterior axillary line, and was oval, 2½ inches long by 1¼ inches broad, extending from the seventh to the ninth rib. No ribs were broken. The wounds were dressed twice daily with lint and carbolic oil. He suffered much from nausea and vomiting on the day on which he received the wound. On the following day, 17th March, he was able to take milk in small quantities, but had high fever. On the 18th and 19th there was less fever, and on the 20th his temperature was normal, and did not again rise. From the 17th to the 23rd he was also much jaundiced. On the day after he was wounded, *i.e.*, on 17th March, a broad stripe of ecchymosis appeared extending from the axilla to the ilium, 6 inches broad, which gradually passed away. From 24th March, by which date the jaundice had disappeared and he had been free from fever for three days, he progressed gradually to recovery, the chief events of his convalescence being as follows :—

On the evening of 23rd March a fragment of necrosed bone, 1½ inches long and about the size of a large pin, came away from the seventh rib through the wound of exit. On the 24th March five No. 8 shot were extracted from the wound of exit. On the 29th March a wad was extracted from the wound of the, entrance, and two No. 8 shot from the wound of exit. Both wounds were now clean and free from sloughs. On 3rd April a sinus, which had formed leading backwards from the wound of exit for 1½ inches, was opened at its posterior extremity, and a drainage tube introduced through it. On 4th April a fragment of necrosed rib came away from the posterior incision. On 4th April three No. 8 shot were extracted from the wound of exit. On 8th April three small pieces of cloth were taken out of the posterior incision. On 13th April a piece of white drill, half an inch square (part of his trousers), came away from the wound of exit, and several No. 8 shot from the incision. On 27th April a small splinter of necrosed bone was extracted from the wound of exit. On 1st May he left for Calcutta, practically cured, the wounds being now only small flat ulcers.

Remarks.—The patient was, I think, lucky to make so good a recovery after receiving a charge of shot in his body at such close quarters. This fortunate result was, of course, due to the angle at which the shot happened to strike him so as not actually to penetrate the abdominal cavity or to wound any important organ. The liver, though not actually wounded, was no doubt bruised, as shown by the jaundice from which he suffered for seven days. I never saw nor heard of him again after he left Purnea, but from the state in which he then was, I have no reason to doubt that the case resulted in complete recovery.

ON SOME CASES OF FROST-BITE AND THE MEANS OF PREVENTING FROST-BITE IN MILITARY EXPEDITIONS OVER PASSES.

BY. H. B. LUARD,
Surgeon-Captain, I. M. S.

In October 1891 I accompanied a small force, consisting of 200 men of the 1-5th Gurkhas and one section Hazara Mountain Battery, with about 900 laden mules and 300 drivers, from Abbottabad to Gilgit.

Our march led us across two snowy mountain passes : the Tragbal 11,500 feet high, and the Bursil 13,500 feet high. The winter, which had already set in, was unusually early and severe. The force crossed the passes on successive days in three nearly equal parties, each consisting of about 100 sepoys, 300 laden mules, and 100 followers, with two British officers.

The first pass was crossed without mishap by all, and the second pass by the first two parties. The third party crossed the latter pass on October 25th. Snow had been falling for some days on the pass. The day we crossed the weather was clear and bright, but a very keen and bitter wind was blowing all day.

The party, which had been encamped at the lower margin of the snow at an elevation of about 10,000 feet, started at 7 A.M. (about three-quarters of an hour after dawn). During the ascent, the recently fallen snow, which was quite soft and about two to three feet deep, offered great obstacles to the laden mules, which sank in up to their bellies at every step. The extreme coldness of the wind soon told on all ranks, numbing the hands and feet and making the task of lifting fallen loads and mules a hard one. The wind also continually drifted the powdery snow, so that the track beaten down by the foremost animals was filled up as fast as it was made.

On the upper slopes of the pass, as the day advanced, the snow became firmer, but a new obstacle was caused by its slippery glassy surface, on which the mules fell again and again, so that progress was very slow.

Although a pucca mule road existed, all trace of it was hidden under the uniform sheet of snow many feet thick.

The top of the pass was not surmounted by the foremost mules till after 1 P.M.; and on the downward slope, as slippery as glass, the constant falling of the mules increased, so that both the animals and the drivers and sepoys continually employed in lifting them became greatly fatigued.

The sun set behind the hill tops at about 2-30 P.M., and the cold immediately became intense, the wind not ceasing.

The result of these difficulties, due mainly to the force being so heavily encumbered with laden mules, was that we were overtaken by darkness, and a large portion of the little force remained all night upon the pass, though throughout the night up to 2 A.M. next morning parties continued to straggle into camp, which was distant about eighteen miles from the starting point, and was situated at the lower margin of the snow.

The shade temperature at starting was 18° F. On the top of the pass at midday, when the sun was shining brightly, it was 20° F., and at the terminal camp at 12 midnight, inside a tent, it was 14°F. I had not a minimum thermometer with me. About thirty sepoys (chiefly of the rear guard, which was out all night on the pass) and seventy followers (all mule drivers, who were also out all night) were frost-bitten, and one British officer. Search parties went out before dawn next morning, and the whole day was spent in bringing in the men, animals, and loads.

Stimulants were administered, and the usual treatment of energetic friction was applied; but it was impossible to employ it very effectually, as more than half the force was disabled. Large fires were lit, and the men placed with their backs to the fires. The worst cases were mounted on mules and ponies, and the march continued for several days till we arrived at Astor, where a more prolonged halt was possible, and the injured men were placed under shelter in comparative comfort, though even here the weather was that of a fine, though severe, English winter. As this was my first experience of frost-bite, I availed myself of this unusual opportunity to note its points and progress with care. I may say briefly that during the first day or two the affected parts were perfectly pale, cold, and without pain or sensation: and those parts which were once and for all killed by the cold long remained in this state.

The doubtful parts above this line first recovered warmth (about the second or third day) and then rapidly became intensely red, inflamed, swelled, and blistered.

The pain which was absent at first for a day or two gradually increased till it was at the maximum in the second and third weeks.

Sensation to external impressions was the last to return, and the parts often remained numb for a long period.

The lines of demarcation began to be formed during the second week, but were not fully formed till the third and fourth weeks.

Several doubtful parts, which recovered some degree of warmth, and later even of pain and sensation, yet eventually became included below the line of demarcation, the slight degree of reactionary inflammation being sufficient to kill them. Consequently one's diagnosis as to the extent of parts killed had to be made cautiously, and was not infrequently incorrect, the ultimate loss of them being eventually greater than one had hoped.

It may be noted that no certain diagnostic distinction can be observed between parts merely numbed and parts actually frost bitten; both are equally pale and cold and without sensation. The same treatment, *viz.*, friction, is applied to both, and only after the result of this treatment is seen can any distinction be manifested.

Moreover, both pain (subjective) and sensation to pain prick were often manifested in parts which presented no other signs of life, and which subsequently proved to be necrosed.

I attributed this pain to the process of ulceration through the nerves at the line of demarcation, referred to the distal parts which were dead: and the sensation evinced by a pin prick to the slight disturbance of these ulcerating nerve stumps similarly referred down. The lines of demarcation were always oblique or conical, the skin being necrosed higher up the limb than the muscles, and the muscles than the bones: leaving a conical stump where the dead parts eventually separated, that seemed peculiarly unfavourable for eventual healing. It seems as if the cold, acting from without, takes effect to the greater extent and area on the skin: less on the muscles below, and least on the most sheltered bones.

The whole of these cases of frost-bite affected the toes and feet in progressively varying degrees: in about ten cases the fingers were also affected, but it did not extend to the palms, and the nose and ears were in no case seriously affected.

The gangrene when affecting only the toes (or fingers) was dry and black: when affecting more of the foot it was moist and grey. In these latter cases the colour of the skin of the toes soon became black; the skin just above was at first pale, then turned various shades of dusky grey: higher up enormous blisters formed, near but chiefly below what proved to be the line of demarcation: the skin about this line was at first pale, then intensely red and inflamed: when the line became definitely formed, one could distinguish the living skin, still intensely red and inflamed from the dead part below which assumed a bruised and bluish tinge.

The connective tissues below the line assumed, in most cases, a brilliant orange tinge, which was very characteristic.

Where the toes or fingers only were affected, the stumps left, even when the bone ends were uncovered and protruding, quickly healed as soon as the protruding bone was cut off with bone-forceps.

Where the injury extended higher up, the stumps at first were so large that they looked as if they could not heal without extensive plastic operations, which would have still further shortened the disabled limb.

However, after a few months, without any operative measures, the stumps slowly skinned over and healed; but the healed stumps exhibited, as was to be expected, a frequent tendency to break down on very slight injury or pressure.

In one case, that of a British officer, who lost 1½ joints of his right great toe as well as the two last joints of his second and third toes, I endeavoured to avoid this result by removing the bones a little higher up, and so providing flaps of sound skin to cover up the bone stumps: the flaps being sutured and healing up without sloughing. This was done about six weeks after the frost-bite, at the same time that the dead parts were removed. I saw this officer nearly two years later, and he was then able to walk perfectly even on hills, and the stumps had never given him any trouble. In all cases the separation of the dead parts was very slow, being rarely complete before the third or fourth week, and in some cases deferred till the second or third month; and in all this process was assisted by snipping through the tendinous and ligamentous structures and disarticulating at the joints.

Eight patients died: one of exhaustion at the end of the first week, before any considerable inflammatory reaction had occurred, or any ulceration; four died in the third week—one from exhaustion, three from tetanus. At this period the discharges began to be very profuse and foul, and a much larger air-space than had at first been sufficient became necessary. One died in the fourth week of exhaustion; one in the ninth week; and one subsequently from the same cause.

It was a remarkable circumstance that no one died on the pass, the first death occurring a week later: also that not a single frost-bite occurred amongst the mules, about half of which remained on the pass all night; none died, though some were rather exhausted.

The following is a tabular statement of the extent of the injuries: —

17 men lost 140 toes between them, giving an average loss of more than eight toes.
6 ,, ,, half of one foot.
2 ,, ,, half of both feet.
5 ,, ,, the whole of one foot.
4 ,, ,, the whole of both feet.
1 ,, ,, three fingers of one hand.
1 ,, ,, three fingers of both hands.
36 ,, ,, part of their toes.

Of the seventeen more severe injuries above tabulated, eight died; of the seven who recovered crippled, four were sepoys, five drivers.

The remainder of the injured nearly all recovered with the power of walking and of earning a livelihood.

The treatment consisted, after the first day, in first wrapping the injured parts in warmed poultices, afterwards applying iodoform freely to the gangrenous tissues, and washing the stumps daily in antiseptic lotions, and dressing them withboracic ointment made with ghee; an extra ration of ghee and of rum was given for the first few days, and as liberal a diet in other ways as was possible.

The dangerous time on these passes, as regards frost-bite, is the late autumn and winter; in some seasons the passes are open late, and large bodies of men might cross with impunity even up to the beginning of December on the hard snow, but this is exceptional.

The danger (apart from snowstorms, which, in these seasons, absolutely prevent passage when they occur) is the conjunction of very low temperature with the difficulties of passing over deep, recently fallen, and, therefore, soft snow; and the presence of a strong bitter wind, which last circumstance should always cause the march over to be postponed. It is hardly necessary to say that reliefs or reinforcements should never be carried out in this season, which can possibly be sent up, by a little forethought on the part of the authorities, earlier: if reinforcements are absolutely necessary, the above points should be carefully attended to in selecting a day for crossing.

As regards foot-wear, boots are not to be recommended, since the foot in them is cramped, and when partially numbed the toes cannot recover their circulation by movement in the boot. The rear guard all wore socks and boots, and were nearly all frost-bitten, as was the British officer who suffered. The natives about the passes wear thick woollen home-made socks, covered by two thicknesses of puttoo bandage, and a grass shoe: and this method is much the best; it allows free play to the toes, is warm, and is that adopted by sportsmen.

The drivers were all provided with a puttoo foot wrapping and grass shoes: but these were mostly lost in going over the first pass. Before going over the Burzil they were made to tear strips from their blankets to replace the former, and were given fresh grass shoes. But many neglected this precaution or lost their foot coverings early in the day.

Sepoys should always be provided with woollen gloves, as ours were: otherwise they could hardly handle their rifles owing to the cold. An early start should be made, before daylight, for such a fatiguing march; though it is hard to get men up in a freezing camp before daylight. The local men usually cross at this time, when the snow is old: as, in the night and early morning, before the sun grows hot, the snow is hard and can be easily traversed. Still, even when the snow is recent and soft, this rule should be observed, so as to avoid the risk of being benighted on the pass.

Moreover, if there is much difficulty and the pass is not half-crossed by noon, it would be better, in cases where much baggage is carried, to leave it on the top of the pass, and so get men and animals into camp safely, returning for it next day. That is, provided the weather is clear, and the stores are not of vital importance to an important expedition, as ours were.

In almost any other case it must surely be better to run a slight risk of losing the stores than to incur a much greater risk of loss of life and limb.

These passes have now been furnished at intervals of four or five miles with strongly-built refuges, standing well out of the snow, which will certainly make it possible to cross them at all seasons, even with a considerable party, provided snowstorms are avoided.

In the spring months of April, May and June, although the extent and depth of snow is nearly as great as in winter, there is little risk, barring snow-storms, in crossing, as the low temperature of winter and autumn is past. I have several times crossed the Burzil in this season without difficulty: once even with a wounded man in a *doolie*.

It is hardly necessary to observe that a liberal supply of warm clothing, both to men and followers, is necessary; and, considering the increased tissue-change required to compensate for the low temperature, a liberal diet should be allowed to all, including a full seer of *ata* and a double ration of ghee and gour, as well as a ration of tea before starting, and a full dram of rum on arriving in camp.

ENTERIC FEVER IN INDIA: ITS DIFFUSION AND PREVENTION.

BY G. S. A. RANKING, M.D. (CANTAB.),
Surgeon-Major, I. M. S.

I PROPOSE in this brief paper to assume the essential identity of the enteric fever as seen in India with that of more temperate regions, inasmuch as the evidence obtainable from the clinical history of cases points strongly in this direction, while the essential features of the pathological changes found in *post-mortem* are identical.

I therefore merely premise that in this paper I wish to be understood as speaking of the diseased condition caused by the *bacillus typhosus* of Eberth, and specially characterised by ulceration of Peyer's patches. It is quite true that in many *post-mortem* examinations of cases where the symptoms during life have been somewhat at variance with the classical symptoms of enteric fever as seen in Europe, we find ulcerative changes in other parts of the glandular structures of the intestinal canal, but these ulcerations are superadded to that ulceration of Peyer's patches which is universally recognized as the characteristic lesion of enteric fever, and in all such cases, by appropriate methods, Eberth's bacillus may be cultivated from the spleen. This was shewn for several cases occurring at Lucknow by Surgeon-Captain Horrocks and myself in 1891.

Nor do I propose to discuss the relative liability of Europeans and natives of India to this disease. No one who has had any lengthened experience in India can doubt that enteric fever is far more frequent among Europeans than among natives of India, though whether the relative proportion of cases is accurately represented by the figures usually given in statistical statements dealing with this subject is a question open to great doubt: and I may here say that, in my own opinion, enteric fever is far more common among natives than such statistics would lead us to believe.

But even admitting, as we must, that a far larger number of Europeans are attacked by this disease, we must, I think, attribute this fact mainly to a predisposition due to impaired vitality brought about by the enervating influences of a tropical climate.

In proof of this we have to consider the mortality at different ages and at different periods of residence in India, and finding as we do that the deaths from enteric fever "in the first and second years of residence are more than double those which occur between the third and fifth years, and nearly five times those between the sixth and tenth years,* we cannot fail to recognize the effect of the tropical climate in lowering vitality in the early days of exposure to its influence. But this is a very different thing to attributing to climatic causes a direct share in the causation of enteric fever, a view which has, from time to time, been advanced mainly, as it would seem, as an excuse for evading the responsibility of efficient sanitary precaution.

With these prefatory remarks I pass on to discuss the first of the two points with which I propose to deal in this paper:—

I. *The diffusion of enteric fever in India.*—There are here, in India, as elsewhere, three sources to which we may assign the diffusion of enteric fever, *viz.*, (1) the soil; (2) the air; (3) food, more especially water: and in putting these three sources in this order, I wish to lay stress upon the view that the *soil* is the principal source in this country, which in this respect displays a difference in the causation of its enteric fever to more temperate regions, where the presence of sewers is so fruitful a source of enteric.

What I desire to insist upon is the peculiar facility for the diffusion of enteric fever, afforded by the conditions of the soil in India, where, for a large part of the year, the soil, or, at all events, its upper layers, are dry and easily converted into dust, while at certain times of the year there occur those atmospheric disturbances familiar to us all, as "dust-storms," by which immense volumes of dust are carried large distances, penetrating, as we most of us have experienced to our discomfort, into the remotest corners of our houses, no matter how carefully we may close our doors and windows, and contaminating in their course the wells, milkpans, and any articles of food which may chance to be exposed.

It is no difficult matter for us, who know of these facts, to conceive how, given a soil containing the

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* Hygiene and Diseases of Warm Climates.—*Davidson*, p. 233.

Bacillus typhosus, this microbe may be so widely diffused by the air laden with dust as to give rise to outbreaks of enteric fever.

The vitality of Eberth's bacillus is very great, as has been abundantly proved by various observers: Uffelmann, Grancher and Deschamps,* Firth,† Dempster‡ and others with whose work we are all probably familiar. We may then accept it as demonstrated that the *bacillus typhosus* can exist and retain its powers of development in the soil (even under the conditions of drying existing in India) for a considerable period, long enough, at all events, to allow of their being transported in a living state by air-currents, thus becoming sources of infection for all foods with which they may come in contact.

The epidemic at Agra in this year, in which three young officers of the East Surrey Regiment lost their lives, was, it is stated,§ traced mainly to contamination of water which had, in all probability, been infected in the way indicated. This being the case, and accepting, as we must, the position that if we have a germ-laden soil, we expose our air and consequently our food to contamination, it becomes, I urge, a duty of primary importance to do all in our power to prevent the soil becoming the nursery for these germs, and to this all other precautionary measures, however important in themselves, must of necessity be merely axiliary.

If we can keep our soil free from enteric germs, the mischief will be checked at its fountain-head. as the other sources of contamination so potent in other countries are absent here. We have, it is true, in our large cities, such as Calcutta, systems of sewers which may lead to soakage and contamination of well water, but this is a local, not a general condition, and that it has no very great influence is shewn by the fact that it is not in the great cities that we find this alarming incidence of enteric fever, but in the up-country stations and cantonments, such as Agra, Lucknow, Meerut, that this disease is such a terrible scourge. Now to the second point :—

II. *Prevention of enteric fever in India.*—Seeing as we have that contamination of the soil is the primary factor in the diffusion of enteric fever, it becomes our first duty to provide means for preventing this contamination, and this can only be done in one way—by *cremation* both of the cadavera and the excreta of enteric patients.

At present the practice is to bury the excreta of enteric cases, after more or less imperfect disinfection, in trenches, sometimes deep, sometimes shallow, according to the way the weather-cock of sanitation happens to turn for the time being, and we go away and flatter ourselves that, having put the excreta out of sight and having secured a minimum of disagreeable effluvia, we have done all that is our duty to do, and have secured our community against infection by enteric. But we have done nothing of the kind, and we must not go on sunning ourselves in our fool's paradise. The disinfection of enteric stools is excellent in principle and is in no sense to be regarded as a work of supererogation, but it is ineffectual as at present practised : possibly certain stools may remain a sufficiently long time in contact with the disinfectant for complete sterilisation, but the exigencies of the conservancy system do not admit of this in all cases, and it may be taken as certain that those motions which happen to be passed shortly before the time fixed for the removal of the conservancy cart are committed to the soil teeming with living and active germs—once in the soil, these enteric bacilli and spores will continue to live, undergoing rapid and continuous multiplication, and we are brought face to face with the fact that the burial of these imperfectly disinfected enteric fever excreta *in* or (as we may say in the case of the shallow system recently advocated*) *upon* the earth is to convert that plot of ground into a nursery garden for enteric fever. All that is needed is for the upper layers of the soil to become converted into dust and be carried off by the wind, and we have our enteric factory fully established.

We may rest assured that in this country enteric fever will increase and multiply and deplenish the earth so long as the present dangerous system of disposal of the excreta of enteric patients is allowed to continue.

It may fairly now be asked: What system are we to substitute for it? and to this I would reply—

Firstly.—The thorough disinfection or rather sterilisation of all enteric excreta with perchloride of mercury at steam heat.

Secondly.—The cremation of all cadavera of enteric patients where such a course is practicable.

Thirdly.—In cases where cremation is impracticable (as in the case of Muhammadans), I would propose that all such cadavera should, prior to burial, be enveloped in sheets soaked in a sufficiently strong solution of perchloride of mercury and hydrochloric acid, previously to which the large intestine should be flushed and the peritoneal cavity injected with this same solution.

These I apprehend are the best possible precautions at our disposal failing the possiblity of cremation.

Of the above alternative methods of disposing of the corpses of enteric patients, there can be no question that cremation is the better, as it affords an absolutely certain means of destroying the microbes which have brought about the fatal issue, and preventing them from inflicting any further injury. What then are the obstacles to cremation?

We must remember that here, in India, we have to deal with three distinct people, led by different religious prejudices :—

(1) Europeans—including Eurasians—who are Christians ; (2) Hindus ; and (3) Muhammadans.

Now, for purposes of cremation, may we class together Hindus and Christians, inasmuch as the Hindu religion enjoins the disposal of the dead by cremation, while there is nothing repugnant to the Christian religion in this mode of disposal of the dead.

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* Centralblatt fur. Bakt., February 5, 1894.

† Hygienic Congress, Portsmouth, 1892.

‡ Roy. Med. Chir. Soc., May 22, 1894.—(B. M. J., May 26, 1894.)

§ Brit. Med. Journal, June 2, 1894, p. 1203.

* Quarter-Master General's Department Circular, 1894.

We may take it, therefore, that the objections to cremation in the case of Christians is mainly one of sentiment and custom, but I believe that if this question can be fairly put before the Christian community in its real bearings, if they can be convinced that a large amount of preventible disease and death is actually caused by earth burial of the corpses of enteric and other infectious diseases, it will not be long before each of us, in the interests of the living, will consent to provisions for the cremation of all corpses of those who have died from diseases capable of being transmitted from the dead to the living, and it will be recognized that the humane procedure is to consign all such corpses to the crematorium rather than to the cemetery. The religious aspect of the question is one which might well be approached by our clergy ; to us, as medical men, belong the duty of insisting upon the sanitary duties involved, while to the lay community must be left the privilege of acting in a body upon the advice thus given them, and forming themselves into a league having for its main object cremation of the infectious dead. It is concerted action of this kind which is needed.

In the case of the British Army the time has, I think, come for dealing officially with the spread of enteric fever in issuing regulations for the cremation of such corpses on sanitary grounds.

Hindus, as I have stated already, use this most sanitary measure, so in their case no steps are needed.

But in the case of Muhammadans, both of the civil and military population, we are confronted with a grave difficulty ; for after careful study of the authorities and in consultation with Muhammadan men of learning, I have no hesitation in saying that although there can be found no specific injunctions against burning the dead, still the injunctions to bury are so strict and the details as to the orthodox mode of burial so explicit, that no good Moslim would allow the corpse of another Moslim to be burned. In the case of Muhammadans, therefore, the continuance of burial appears unavoidable, but the precautionary measures might, I think, be adopted without objection.

Another question which arises is the financial one, and without going deeply into this question it has, I believe, been estimated that the cost of cremation should not on an average be more than one-half that of burial.

I would invite the attention of all interested in this subject to two very interesting and instructive papers on Cremation in the "British Medical Journal" of August 11th, 1894.

But whatever may be the opinion on the general question there can, I think, be little doubt that in cremation we possess the only really efficient means of preventing the diffusion of enteric fever in this country. If this is so, it becomes our paramount duty to do all in our power to promote its universal adoption in so far as the religious prejudices of our fellow subjects in India will permit.

With cremation of infectious cadavera, and sterilisation of infectious excreta, and the auxiliary precautions as regards contamination of our food-supplies, supervision of dairies, filtration of water, etc., we may confidently hope that, in course of time, enteric fever, at present a terrible and increasing menace to public health and private security, will be relegated to the limbo of vanquished terrors, and we may hope also that in time to come this happy consummation will be looked upon as not the least of the fruits of our First Medical Congress.

ENTERIC FEVER AND TEETOTALISM IN THE BRITISH SOLDIER IN INDIA: A PLEA FOR A BETTER SYSTEM OF WATER PURIFICATION.

BY S. F. FREYER, M.D.,
Surgeon-Captain, A. M. S.

A TONE of hopelessness and resignation to the inevitable pervades the reports of the various medical officers all over India, who, in the recent Annual Report of the Sanitary Commissioner with the Government of India, have contributed their views with regard to the causation of enteric fever in the European soldier. Nor is this to be wondered at, when it is seen that, in spite of all the precautions taken, the disease is fast increasing, and may now be said to have gained an endemic footing in all our larger cantonments. It is true that many of these medical officers still refuse to admit the possibility of its origin in barracks, and attribute case after case to outside causes—bazaar drinks, bread, etc. But, were the reasons given for such a conclusion more convincing, it would be difficult to reconcile this theory of invasion from without, with the comparative immunity of the native population from the disease. and the constantly increasing number of cases amongst the troops, notwithstanding the more careful supervision and sanitation of the bazaars and followers in recent years.

In the maze of opinion collected in this report, as well as in those of previous years, there is only one point upon which all medical officers seem agreed, namely, that youth and recent arrival in the country predispose to the disease, and that as these are some of the disadvantages of our short-service system, so only in recent years have they made themselves felt. This behaviour of enteric fever towards youth and recent arrival, first noticed by Bryden of the Bengal Medical Service, has been so fully confirmed by ourselves, as well as by the experiences of the French in Algiers and Tunis, as to have now obtained almost the sanction of a law.

That youth and recent arrival in India are concomitants of the disease the statistics clearly show ; that they are more than mere concomitants seems highly probable from such unanimity of opinion in the matter. It is, however, proposed in this paper, to submit for consideration another factor which does not seem to have attracted any marked attention in this connection up to the present time, which has gone hand-in hand with the increase of enteric fever in the British soldier in India in recent years, and which further promises to be of some use as a guide in endeavouring to trace the origin of an epidemic.

For the past two years, whilst in charge of large enteric wards in station hospitals out here, it has been my habit—entered on at first chiefly with the object of excluding ardent fever—to enquire carefully into the previous circumstances of each case admitted. Amongst other things I was soon struck by the large proportion of teetotalers under treatment. For instance, in the R. I. Fusiliers at Allahabad last year, I noted as many as six successive admissions amongst teetotalers, although the latter numbered at the time not more than one-fifth of the strength of the regiment. Even then only an occasional beer-drinker would be admitted, to break this succession of teetotalers, and although in the 34th Field Battery, which was stationed there at the same time, this preference for the teetotaler was not so marked, they, too, showed a proportion of teetotalers admitted with enteric, which was not quite warranted by their strength, as compared with the non-teetotalers in the battery. Enquiries at other stations since then, and casual notices of this state of affairs by other officers in the service, have convinced me that the teetotaler in barracks in this country is much, and in some epidemic enormously more liable to enteric fever than his ordinary beer-drinking comrade.

I had better at once state that I do not attribute this to the absence of alcohol in his drink, but rather to the fact that, being a total abstainer, he is more dependent than his fellow beer-drinker on impure barrack-water, which I hope to show in this paper to be the main source of enteric in our troops.

The following figures will show that my observations at Allahabad were not exceptional. At Umballa this year—from the 25th April, the date on which I took over charge of the 18th Hussars, up to the 15th August —out of a total of twenty-four admissions for enteric fever from this regiment, there were fifteen teetotalers, and two more practically teetotalers for at least a month previous to admission; thus leaving only seven non-abstainers. As the average strength of the regiment at the time was 507, and there were in all 153 reputed teetotalers, by a simple arithmetical calculation, we find that the teetotaler was practically five-and-a-half times more liable to the disease than his ordinary comrade.

Again at Sabathu—a hill station occupied by the 1st P. A. Somerset Light Infantry—there were thirty-eight admissions for enteric fever in the six months, from April to September, this year. Twenty of these were convalescent and able to march down with the regiment quite recently to Umballa, so that I had the opportunity of questioning them individually. I found that, previous to their admission into hospital for the disease, fourteen of them were teetotalers, two practically teetotalers, and only four beer-drinkers. The average strength of the regiment for the six months under consideration was 765, and the average number of reputed teetotalers 308. The latter is an unusually high proportion; but still, calculating the risk of the teetotalers on the twenty cases examined—and I have no reason to think that the rest, if they could be included, would give a different indication—it comes out to be nearly six times that of the beer-drinker. From two other regiments, one of them stationed in the hills, and one partly in the hills and partly in the plains—in fact from all that I have had an opportunity of examining so far—I have had similar, if less, striking results.

Thus it appears that this greater liability of the teetotaler holds good in the hills as in the plains: whether the water-supply is from country wells or the more elaborate water-works system. This latter fact is of great importance ; for, as will be seen later on, there is still one possible source of impurity in the water-supply common to all.

In the particular instance of the 18th Hussars, we were led to the filtered drinking-water in barracks or stables, or both, as the source of the disease, although such was not previously suspected; we were led to this conclusion by the process of elimination of other sources of infection, bearing the following facts in mind: (1) The sudder bazaar was "out of bounds" most of the time under consideration on account of small-pox prevailing there. (2) It is generally known in regiments that the teetotaler is a careful man with his money; and it is only giving him his due to say that he would not visit the bazaar more frequently than the beer-drinker, to indulge in those bazaar drinks, bread, etc., so plausibly put forward by many as an explanation of the prevalence of enteric fever in the army in India. (3) The milk-supply was from the regimental dairy, looked after by regimental orderlies; and, should an occasional chance have been given for its dilution, there was no water, other than filtered tap-water, to be found in the vicinity of the diary. Few of these patients, however, acknowledged to partaking of milk, except in tea. (4) The aërated waters in barracks, as well as in the Temperance Halls outside barracks, were above suspicion, except in so far as the filtered tap-water used in their manufacture was concerned; but this opens up a question which I propose entering into at some length presently.

There was, then, only one possible source of infection, and that was the drinking-water from the filters in barracks and stables, which was practically the only water-supply.

This question of the purity of aërated waters, and their safety in use, is of such vital importance to all Europeans in India, knowing, as we do, that the so-called soda-water is practically the drinking-water of the general European community here, that I propose dwelling at some length thereon.

About eighteen months ago, whilst on short leave at Simla, I obtained permission from the proprietor of a soda-water factory there to make the following experiment: I had an idea for some time previously that the so-called soda-water was, to all intents and purposes, a sterile fluid, and I wished to put the matter to a practical test. Taking some fresh beef-steak, I cut it up into half-inch cubes, and having previously well washed some soda-water bottles, I introduced a cube into each, and filled the bottles in the ordinary way in the machine. Some were filled at full pressure (120lbs.), with rocking to expel the air; some at full pressure without rocking; a few at half pressure; and, lastly, two of them without pressure, but plugged at the mouths merely with a piece of cork and cotton wool respectively. Leaving them all standing on end in my verandah, I awaited the result. The weather was warm even in Simla then, although it was only the beginning of the month of May. In the course of the next day some bubbles of gas were noticed rising towards the surface from the meat in each of the two bottles which were not under pressure; and this continued, until at the end of a week a whitish film had also formed on the surface of the water in them. The bacterial masses—for such they undoubtedly were—grew apace afterwards, accompanied by the evolution of foul gases. Meanwhile, none of the other bottles, at half or full pressure, with or without air expelled, seemed to have undergone any change; and, when, at the end of three weeks, they were opened, the beef in all of them was still sweet, and only a little hardened apparently. Not having the necessary apparatus, nor sufficient practical experience in bacteria-culture to pursue the subject any further, I was obliged to leave it at this stage. It was, therefore, with much interest that a few weeks later I read in the British Medical Journal, 3rd June, a description of the d'Arsduval filter for sterilizing Brown-Sequard's gland extracts—in principle the same as our soda-water machine—and in the following December Hankin's communication to the *Indian Medical Gazette* on the bacterial purity of soda-water, so the pressure of the gas in each instance seems to be attributed the chief germicidal action; and, probably, this is to a certain extent true, notwithstanding Tyndall's earlier experiments with air under a pressure of twenty-seven atmospheres,* in which he did not find that the pressure affected these small organisms deleteriously.

Hankin, however, states that " the gas in the soda-water acts as a poison to the microbe," and if this also is the case, we can easily understand what a virulent bactericide bottled up soda-water must be. For water at the ordinary atmospheric pressure absorbs its own volume of carbonic acid gas, combining with it loosely at the same time, so that in an unopened bottle of soda-water at 120lbs. (eight atmospheres) pressure, there would be, according to Boyle's law, nine times this volume of the gas, thus rendering the water intensely acid ; whilst, at the same time, owing to its loose combination, the gas would always be in the nascent state, and therefore most active, and, it is presumed, deleterious to pathogenic bacteria, which find a suitable habitat in the human body ; although less so, it is said, to the particular variety of bacterium which concerns us in this paper than to other forms; as, for instance, Koch's bacillus of cholera, which, we are told, at once perishes in even a weak acid.

The influence of light, too, as freely transmitted through these transparent bottles, is not to be lost sight of ; for, as Professor Percy Frankland, in the *Nineteenth Century* for May last, shows sunlight has a very destructive action on pathogenic bacteria.

But however this destructive action is brought about, Hankin's experiments go far to prove that soda-water, after standing a reasonable time at least, is purified from bacteria ; and this is the practical point in the matter.

Probably the other aërated waters drunk by the men —the sweet and the tonic waters are thus purified also only to a lesser extent, and varying in each case with the amount of pressure used in the bottling—a test which can be readily applied by every one in the opening of the bottle. It is as well to mention that the name soda-water is a misnomer in this country, for no soda is used in the manufacture of such ; it is only plain aërated water.

Should Hankin's experiments be confirmed and pushed to a more conclusive termination, as there seems every reason to believe they will be, means may probably be found for the purification of water on the large scale by this method alone; but, for the present, even in this country, where it is sold as cheaply as possible, soda-water must be considered a luxury to the soldier, so that he remains more or less dependent on the filtered water supplied him in barracks for the making up of his daily quantum of fluids—more in the case of the teetotaler, less in the case of the beer-drinker naturally, and, as is held here, in direct proportion to his risk of contracting enteric fever.

The universal prevalence of enteric fever about barracks in India, whether in the hills or the plains, its apparent independence of the system of water-supply—and at the same time its preference for teetotalers—all point to a common source of contamination in the distribution of the drinking-water. This is nothing else than the regulation filter used in barracks, which fulfils all the necessary conditions in this source of contamination; for it is the only portion of the water-supply system common to all barracks in India, and reference to the Bengal Barrack Regulations will show what a complicated filter this Macnamara filter is, and how easily, through want of skill or care on the part of those who attend to the charging and cleaning of it, the object for which the filter was intended may be frustrated.

But, apart from this, it is no longer doubtful that the filter, at its best, will not prevent micro-orgnisms of disease from passing through; and, further, there is good reason to believe that it may be a source of danger, instead of safety, placed where it is in the last line of defence, so to speak. For, whatever influence of a destructive nature charcoal, under the influence of sunlight, and with a free access of air, may have on pathogenic bacteria, it is not credited now-a-days with anything much more than a mere mechanical action on them as a strainer, when placed under the conditions found in a filter; and it is not by any means an efficient strainer either. Added to this is the possibility that the filter, in the form under consideration, with its outside iron case, and upper compartment of still water holding phosphates in solution, and shut off from the influence of light, may turn out to be, when placed in the hot Indian barrack, a veritable incubator for any stray bacteria which once find their way into the water-supply in any part of its course. The still water in the top compartment is that next the tap—ready for drinking in fact—and holding, as this compartment does, only a limited and small quantity, it can be readily understood how, in such a case, one or two men only at a time would become infected, and so the filter would escape suspicion.

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* " Floating Matter of the Air." By John Tyndall, 2nd Edition.

It is, I believe, the complete reliance which is placed on this filter in the army in India generally that is responsible for the large amount of mysticism at present prevailing as to the cause of enteric fever in our barracks out here. The fact that in the French Army enteric fever has disappeared in the epidemic form, and is met with now in sporadic cases only and at long intervals, since their adoption in 1889 of the Chamberland filter,* lends much weight to this view of the causation of enteric fever in barracks in India. The Chamberland filter, if not an ideal one for our army in India, seems certainly to have fulfilled its purpose well in France. In 1886-87, before the introduction of this filter into the French Army, the annual average of admissions for enteric fever was 6,884; in 1889, when part of the army was supplied, this fell to 4,412; in 1890, as the number of filters increased, it fell to 3,491; and in 1891, when there were 200,000 of these filters in use and 45,000 still not set up, the average had reached as low as 3,225†. These figures speak for themselves and form a marked contrast to the steady increase of the disease in our army in India. They further indicate the necessity for the adoption of a rational filter as the available means by which we may hope to stamp out enteric fever from barracks in this country. The initial expense of such a proceeding would, no doubt, be considerable; but, even from a financial point of view, it would seem a good investment; and when we consider that one-third of the British Army in India at the present day—22,802 on the 31st March last‡—are teetotalers, there is all the more reason, if we are to encourage the temperance movement, that we should spare no effort or reasonable expense in guaranteeing the men a supply of safe drinking-water in barracks.

NOTES ON ENTERIC FEVER.

BY W. H. HORROCKS, M.B.,

Surgeon-captain, A. M. S.

The following observations are taken from my notes on 185 cases of enteric fever which have been treated in the station hospitals at Lucknow, Fyzabad, and Bareilly. In cold climates enteric fever is said to be one of the most variable of diseases. How much more is this likely to be the case in India, where, in addition to the specific poison of enteric fever, exposure to the sun and malaria are always more or less potent to produce, not only their own manifestations of disease, but also to modify the results of specific infections. Accordingly in my notes many types of enteric fever have come under observation. The typical classical three-weeks fever, associated with rose rash, diarrhœa, and abdominal fulness, has been frequently noted. An abortive fever of only fourteen days duration has often been met with. Sometimes continued fever has been present for many weeks. All the typical symptoms of enteric fever have been observed; and yet, on *post-mortem* examination, lesions have only been detected in the large intestine. Cirrhosis and abscess of the liver have occurred as complications rendering the diagnosis exceedingly difficult. On making an analysis of the symptoms and *post mortem* appearances presented by these various cases, some interesting results were obtained.

The temperature, though often presenting the typical curve of the text books, not seldom rose suddenly, and at the end of thirty-six hours illness, often registered from 103° to 104°F. This point was again and again observed in cases which developed in hospital, and had been under treatment for syphilis, or other diseases for some weeks. During the first and second week of disease, the temperature often for one day dropped to normal in the morning, and then rose again in the evening to its former level. In the third and fourth weeks, marked intermissions were often seen, accompanied by all the usual signs of intermittent ague. In one remarkable case, presenting marked abdominal symptoms, the temperature after the sixth day was regularly intermittent, until convalescence was established.

The tongue presented a very characteristic appearance in typical enteric cases. At first coated with white fur in the centre and abnormally red at the tip and edges, it speedily dried in a triangular patch at the apex. In the second week transverse cracks commonly appeared. Sometimes the tongue was smooth and clean, and of a brilliant red colour. Several cases were noted with a natural moist tongue from the beginning to the end of the disease.

Diarrhœa was present in ninety-nine cases, the stools being usually light yellow in colour and alkaline in reaction. On microscopic examination of these stools, large granular cells, leucocytes, crystals of triple phosphates, and bacteria were seen. In six cases stools of a bright, green colour, containing numerous white flakes, like undigested milk, were observed. Under the microscope large quantities of granular cells, with large nuclei were seen. These green stools were always alkaline in reaction, and were generally associated with marked abdominal symptoms. They were not always present throughout the case, but with their appearance there was generally a rise of temperature and increased timidity of the abdomen. Constipation was a marked feature in seventy cases, and often associated with severe ulceration. In the case of Pte. H, of the Rifle Brigade, constipation was present until the eighteenth day of disease, when perforation occurred. Constipation may be associated with ulceration in the large intestine. In the case of Pte. S., Royal Irish Regiment, constipation was marked. During the second week of his disease, death occurred, and on *post-mortem* examination ulceration of Peyer's patches, and also of the solitary glands in the large intestine, was found.

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* Journal Officiel du 12 Févier 1891.

† "Les Maladies du Saldat" par M. Marvand, 1894.

‡ Annual Report of the Army Temperance Association, 1894.

Perforation occurred in ten cases. The seat of perforation was usually in the ileum, about six to eight inches from the ileo-cæcal valve. In two cases the perforation was in the vermiform appendix. A small ulcer, exactly like those present in the ileum, was found penetrating to the peritoneal cavity. No extravasation of fæces occurred, the coils of intestine being firmly matted together by a localised peritonitis.

In many cases cardiac weakness was a marked feature, due partly to the action of the toxines and partly to fatty infiltration of the heart. In a large number of *post-mortem* examinations, fatty infiltration and degeneration of the muscle of the ventricles was detected. In long continued cases such a condition would probably be caused by the febrile process alone, but extreme degeneration was noticed in many cases, dying as early as the sixth or seventh day of disease. In *post mortem* examinations made on soldiers dying from injury the same condition has been frequently noticed. A want of correspondence between the rate of the pulse and the temperature was found in a large majority of the cases. A pulse of seventy to eighty beats in the minute being not uncommonly associated with a temperature of 103° F. It cannot be considered diagnostic of enteric fever, as it was also noticed in several cases of pneumonia and bronchitis. Still it was a marked feature in the charts. Hæmorrhage occurred in fifteen cases. Four times between the seventh and twelfth day of disease, all these cases recovered. In the remaining eleven cases the hæmorrhage came on in the third, fourth or fifth week, and all the men died. Hæmorrhage occurring about the end of the first week of disease, seems to be the result of intense congestion of the ileum or large intestine, and the general health not being so undermined as in the later periods of disease, the prognosis is distinctly good. In the third to fifth week hæmorrhage was found to be the result of penetration of one or more of the branches of the mesenteric arteries, except in one case where hæmorrhage came on in the fourth week, and after death the Peyer's patches were found cicatrising, but the large intestine was intensely congested.

Delirium was marked in twenty cases, but on *post-mortem* examination the meninges were found healthy, except in two cases, which during life were marked by extreme drowsiness. In these two cases fluid was found under the dura-mater in the occipital region.

The urine was carefully examined in forty-five cases, and in fourteen albumen was found. In two cases only a trace of albumen was detected, which disappeared in a few days. In twelve cases the albumen was very marked, and persisted throughout the disease.

In fourteen *post-mortem* examinations, pathological changes were found in the large intestine. In three cases the gut from the caput cæcum to the rectum had a granular appearance. In the remaining cases circular ulcers were seen about half an inch in diameter. No specific symptoms were ever present, by which extension of disease to the large intestine could be confidently predicted. Tympanites did not appear to be more marked than in the cases in which the ulceration was confined to the small intestine. Rose rash appearing in crops was present in seventy-four cases. Thrombosis of the femoral vein was met with six times: five times in the left side and once on the right.

A true relapse coming on from five to six days, after the primary fever had subsided, was met with six times. In two cases rose rash, abdominal distension and diarrhœa were absent from the primary fever, but appeared in the relapse.

The cases in which fever persisted for only ten to fourteen days were often difficult to diagnose from fever caused by exposure to the sun. In young soldiers, it is very common to get a fever of about fourteen days' duration from exposure to the sun on the ranges. The temperature rises suddenly, the conjunctivæ are injected, and the pupils usually contracted. The abdomen often becomes slightly full, and diarrhœa may be present. At first sight these cases are extremely like mild abortive enteric attacks. But there is never the dull heavy expression of the true enteric. Rose rash is never seen. The stools, though yellow in colour, are acid in reaction, and under the microscope epithelial cells, bacteria and triple phosphates are never seen.

The cases in which symptoms of enteric fever were associated with continued fever extending over many weeks, are very interesting, and their exact pathology cannot as yet be determined, as they all recovered. In the case of Lance-Corporal H., 16th Lancers, fever continued for eighty-one days. During the first three weeks his condition strongly resembled an ordinary enteric case. Then the abdominal symptoms disappeared, and he suffered from rheumatic pains, chiefly in the hip joints. The bowels were obstinately constipated, and he gradually became extremely emaciated. In Surgeon G.'s case fever continued for sixty-four days. He suffered from abdominal distension, pain in the right iliac fossa and epistaxis. The bowels were constipated, and the liver and spleen gradually became much enlarged. In Pte. C.'s case fever did not maintain a continued type throughout the disease, but seemed to come on in successive waves during a period of 250 days. After the first three weeks, he never showed any abdominal symptoms, but the liver and spleen gradually became much enlarged, and he suffered from rheumatic pains in the joints of the lower extremities. How are these cases to be explained? Are they pure cases of enteric fever, in which the febrile process was maintained by the slow healing of ulcers and fresh infection of Peyer's patches, or instances of the effect of the combined action of the poisons of enteric fever and malaria? In the notes there are numerous cases of continued fever, extending over thirty to forty days, but in these every abdominal symptom persisted until the temperature became normal, and there could be no doubt that the fever was connected with pathological processes going on in the intestines. In the three cases described, abdominal symptoms disappeared quite early in the disease, and enlargement of the liver and spleen with rheumatic pains in the joints were marked symptoms. The men did not appear seriously ill, and their appearance was quite different from that of the men suffering from enteric fever. Charts of these cases and typical enteric cases, with relapses, are offered for examination and comparison.

The last case to which reference will be made illustrates how enteric symptoms may be present with lesions confined to the large intestine. Gr. B. was admitted into hospital suffering from what appeared to be an ordinary attack of enteric fever. In the second week of the disease hæmorrhage came on, but was arrested by treatment. In the third week typhoid symptoms developed, and the man died from exhaustion. On *post-mortem* examination the Peyer's patches and solitary glands in the ileum were found quite healthy, but in the large intestine, numerous circular ulcers, about half an inch in diameter, were seen. They had exactly the same appearance as the ulcers found in the large intestine in typical cases of enteric fever. In Professor Cayley's edition of Dr. Murchison's continued fever, a similar case is recorded on the authority of Sir Wm. Jenner. Double optic neuritis was detected in only one case.

The chlorine treatment advocated by Dr. Burney Yeo, has been given a fair trial during the last two years. The chlorine mixture was prepared according to Dr. Yeo's directions, and administered every three hours immediately after the men were admitted to hospital. The following effects were observed:—

(1) The tongue and mouth were much cleaner than in the cases treated only with dilute hydrochloric and sulphuric acids.

(2) The foul putrefactive odor of the fæces was to a large extent removed.

(3) Sustained depression of the febrile temperature was only observed in a very few cases.

(4) The average course of the fever did not appear to be shortened. It is true that many of our cases did not come under treatment, until after five or six days illness, so that much valuable time was lost.

(5) Delirium and typhoid symptoms were present in only a small percentage of the cases, and the great majority of the men were able to return to duty after two months' convalescence.

Marked pyrexia being present in most of our cases, in spite of the antiseptic treatment, anti-pyretics, cold baths, ice sponging, and the ice cradle were all used to reduce the temperature.

Ice sponging and packing were found the most useful, and were never followed by cardiac depression. During the first fourteen days of the disease, it was found that phenacetin and antifebrin, given in eight or five grain doses respectively, only reduced the temperature about three degrees for a period of four hours. Antifebrin always produced free perspiration, but after phenacetin, sweating was rarely observed in the enteric cases, though in the malarial fevers it was often marked. Both these anti-pyretics often produced severe cardiac depression and stimulants lead frequently to be given after their use. As so many of our cases showed a feeble circulation, even on admission to hospital and fatty infiltration and degeneration of the heart, muscle, were found in many *post mortem* examinations, the routine treatment by these anti-pyretics was abandoned. It is true that in the third and fourth weeks of the disease, smaller doses of phenacetin and antifebrin were required to make a reduction in the temperature, but at this period of the illness, the cardiac depression was often very alarming, even after very small doses, and a sudden fall to 98° F, with symptoms of collapse was frequently observed, even when only two grains of antefebrin or five grains of phenacetin had been given.

Turpentine was found to be a most valuable drug. Ol terebinthinæ, in twenty minim doses, was given every four hours, and under its influence dry black tongues became clean and moist and tympanites rapidly disappeared. Albuminuria was not found increased by its use, and it was safely given, even when the albumin amounted to one-third. As a general antiseptic, it seemed to be more powerful in its effects than chlorine.

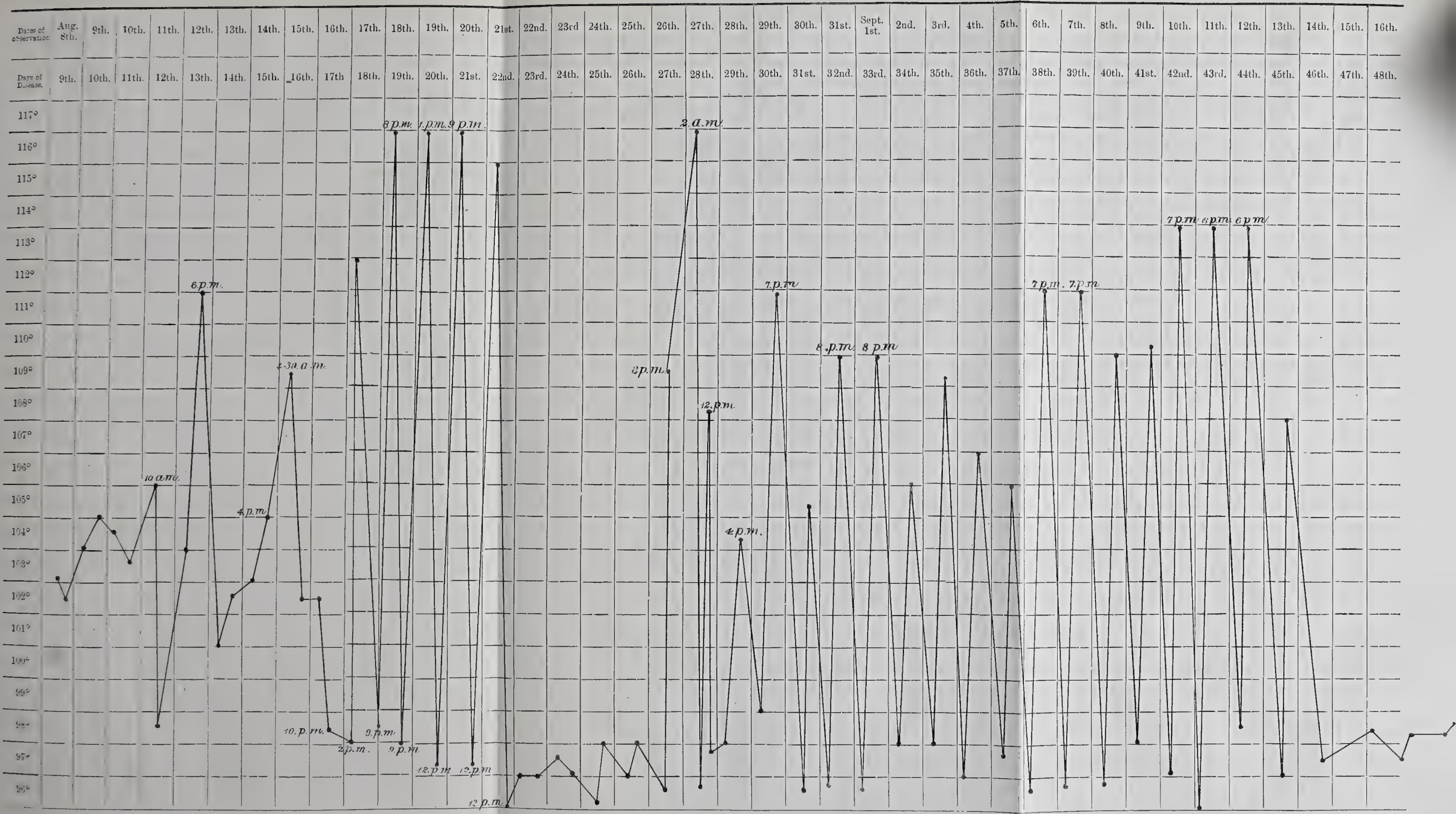
TYPHOID FEVER AMONG NATIVES OF INDIA IN THE PUNJAB.

BY RAM KISHEN, L.M.S.

The author began by remarking that many high medical authorities in India held that typhoid fever was very rare among natives, and that their immunity from it was due to their being vegetarians, or at least to their very limited use of flesh as food. He then stated that in nineteen years of professional life in the Punjab, he had seen many cases of typhoid fever among natives, and that he was inclined to think that vegetarians were just as liable to the diseases as meat-eaters. He regretted that, owing to particular prejudice, he had been unable to obtain *post-mortem* evidence of the disease among natives.

He attributed typhoid fever to defective sanitation, but was uncertain as to whether it arose *de novo*, or was of bacterial origin; but even if the latter are the case, he advocated improved sanitary measures as tending to diminish or destroy the growth of infective organisms. The poison, of whatever nature, was not active in the summer months, when filth exposed to the sun underwent rapid decomposition, the resulting grass poisoning the atmosphere. In spring, when in addition to a lowered temperature, there was abundant vegetation, the poison was least active; and in the rains filth was worked into the soil, where it underwent natural disinfection.

There are many difficulties in the diagnosis of typhoid fever in natives, the chief one being that in adults, the disease was nearly always modified by the patients having previously suffered from it in child-


Dates of observation.
Aug. 8th.
9th.
10th.
11th.
12th.
13th.
14th.
15th.
16th.
17th.
18th.
19th.
20th.
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22nd.
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26th.
27th.
28th.
29th.
30th.
31st.
Sept. 1st.
2nd.
3rd.
4th.
5th.
6th.
7th.
8th.
9th.
10th.
11th.
12th.
13th.
14th.
15th.
16th.
Days of Disease.
9th.
10th.
11th.
12th.
13th.
14th.
15th.
16th.
17th
18th.
19th.
20th.
21st.
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44th.
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117°
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10 a.m.
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1 p.m.
9 p.m.
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8 p.m.
2. a.m.
12. p.m.
4 p.m.
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6 p.m.
6 p.m.

hood. In children the disease ran a mild course, and was generally lesser, as infantile remittent fever; though he had no doubt, from the many cases he had observed, that the disease really was typhoid fever.

The reason why Europeans suffered so much from typhoid fever soon after their arrival in the country was that they had not been rendered immure to the disease by previous attacks in childhood.

Native opinion held that typhoid fever was no new disease in India, and there was plenty of evidence to shew that it had existed a very long time. Some of the authors' cases were diagnosed by experienced *hakims*, as Hum-i-muluka or Tap-i-muluka. This fever was described in authoritative Persian medical works. For example, in *Tib-i-Akbar*, it was described as a continued fever of a severe type, in which the crisis takes place on the 14th or 21st day. It was said to occur commonly in children and young adults, but rarely in old people, in whom it was generally fatal. In children it was said to be milder than in adults. It effected the liver and brain; diarrhœa was often present, the tongue dry and rough, and the eyes sunken. It was said to be very resistant to treatment.

A CASE OF TYPHOID FEVER WITH EXTRAORDINARY HYPERPYREXIA—RECOVERY.

BY J. F. TUOHY, M.D.,
Surgeon-Major, I. M. S.

THE following notes of this remarkable case are worthy of record, as showing the height which the human temperature may attain, in exceptional instances, without proving fatal.

The case which forms the subject of this paper occurred in Sister E—, of the Naini Tal Convent, aged 38 years, born in Bavaria, and twelve years resident in India.

The mode of invasion was somewhat unusual for typhoid. She was in close attendance on a severe case of typhoid fever which terminated fatally on the 15th day from intestinal hæmorrhage and perforation. She removed the last stool of this patient, which was highly offensive, and which she said she felt she inhaled, becoming immediately nauseated and giddy. The next day (July 31st 1891) she was suffering from diarrhœa and sore-throat, followed the day after, August 1st, with pains all over the body, especially in the joints. On August 9th, I diagnosed typhoid fever, and all the signs and symptoms of typhoid fever were observed during the course of the illness. It is to the extraordinary freaks of temperature—if I may use such an expression—that I desire to invite your attention.

From August 9th (tenth day of the disease) the temperature showed decided signs of taking a high range, but the first day of hyperpyrexia was August 12th (thirteenth day of the disease). On that day at 6-30 P.M., while the temperature was being taken in the mouth, the thermometer burst at the bulb with the mercury at the very top of the column registering 112° F. This thermometer, like many of these instruments, was marked only up to *110° F*, but there was space equal to about *2° above the highest* mark occupied by the column of mercury. I was at once sent for, but happened to be in a distant part of the station, and there was such delay in the message reaching me, that I did not get to the patient until 10-30 P.M. I then took the temperature in the axilla, the patient objected to its being taken again in the mouth lest the thermometer should burst—and I found it to be *111°2′ F.* The pulse was 120, face dusky and anxious, breathing rapid and shallow, but the mind was perfectly clear. With such a temperature for four hours I looked upon the case as hopeless, and ordered her into a pack at once of the coldest water procurable. In half an hour (11 P.M.) the temperature had fallen to 98° F., and the patient was put back to bed feeling drowsy and tired. This series of events recurred repeatedly until convalescence was established. After August 12th the hyperpyrexia never lasted so long, though it frequently took a higher range. As will be seen from the chart on four different occasions it reached the extraordinary height of 117° F. On two of these occasions the thermometers burst at the bulb, with the mercury at the very top of the column, so that the temperature recorded can only, strictly speaking, be considered the bursting point of the thermometers, the actual temperature of the patient being no doubt higher. On five occasions the thermometers burst, and we were at our wits' ends to get instruments that would register above 114° F.

Two of the thermometers which burst were graduated up to 110° F. and three to 115° F.; in all of them there was a space above the index equal to about 2°, and when the mercury filled this, or the thermometer burst, the temperature was recorded at 112° F. or 117° F. respectively.

The case being such a very remarkable one, I invited Surgeon-Major L. B. Ward, A.M.S., to verify the temperature. Luckily he was present during the rise of temperature on September 12th (forty-fourth day of the disease) when the thermometer was found to register 114° F. For weeks at a time the temperature was taken every fifteen minutes, as it used to run up in an incredibly short time, and it was felt that death must take place if hyperpyrexia were allowed to last. The patient's ultimate recovery was, I believe, in no slight degree due to the rapidity with which the temperature used to be brought down. The patient herself usually knew when the hyperpyrexia was coming on, and used to entreat to be put into the pack. She informed me that she felt on these occasions as if her heart would burst with heat, and as if she had a tight cord tied round her waist. For further particulars of the case I must refer to the special notes at the foot of the temperature chart, but what occurred to me as one of its most remarkable features was that there was not more marked cerebral disturbance, and I must leave physiologists to determine how any human being could exist for four hours with a temperature of between 111° F. and 112° F. with the mind perfectly clear.

There was no history of injury, and from the date I diagnosed the case, I never had any doubt that it was one of typhoid fever, with extraordinary disturbance of the thermogenic centres, caused, probably, as Dr. Hule White has shewn, by a series of small hæmorrhages into one or more of the great nerve centres of the base of the brain.

There was a discussion at one of the London societies many years ago, reported in the British Medical Journal, in which many even more extraordinary cases of hyperpyrexia were mentioned. I have been unable to refer to the Journal in which these cases were mentioned, but I believe they were all fatal, while the remarkable feature in the case I have described is, that it recovered.

As might be expected convalescence was very protracted. It was quite two months after the complete disappearance of fever before the patient could do more than walk across the room. I am happy to say, however, that no permanent ill-effects remain, as I saw the lady in July of the present year—just three years after her illness—when she was in the enjoyment of perfect health. I will now conclude this paper with a few brief remarks on the treatment adopted. In common with many others I found the administration of antipyretics disappointing, and in this and other cases I have come to the conclusion that they are often injurious, and seldom to be depended upon in cases of hyperpyrexia. The snow water pack never failed to bring down the temperature, and it was repeated every time the hyperpyrexia came on. The ladies of the convent became so expert at giving this pack that it never took more than three or four minutes to get the patient into it. I should mention we used snow as there was no ice to be obtained in the hills. As I feared heart failure, of which we had several warnings, I gave brandy with a free hand: towards the termination of the case one ounce every hour was given while the patient was awake. I confirmed an observation often made of the value of quinine in large doses in cases of prolonged typhoid in India. While quinine was useless in the early days of the case before any certain diagnosis could be made, its action was prompt and permanent towards its close.

DISCUSSION.

Surgeon-Colonel Cuffe, C.B., A.M.S., said that the recommendations made in Dr. Ranking's able paper as regards the thorough disinfection of all dejecta from enteric fever patients were well worth the attention of all sanitarians. There was only one thorough way of effecting this, *viz.*, by complete destruction by fire.

He considered that a furnace for the purpose of cremating all dejecta, enteric or other, of hospital patients, or a steam sterilizer, such as was exhibited at the meeting of the British Medical Association in Newcastle-on-Tyne in 1893, should be part of the requisites of all large hospitals, military or civil. It was a matter for consideration whether the disposal of all excreta from hospitals by burial in sewage trenches or grass farms should not be prohibited.

With regard to the conveyance of enteric fever by milk, he thought there was very little doubt among medical officers that it was a potent source of the disease. The *goallas* and other natives engaged in supplying and distributing milk to barracks and hospitals, as well as to private persons, had frequently been detected in adulterating the milk, possibly the water used for the purpose was merely diluted sewage.

Soda-water and other aërated drinks made from polluted water and distributed in imperfectly cleaned bottles were to be found in every bazaar and cantonment. As supplied to soldiers, however, in barracks and under supervision, aërated waters were usually unobjectionable, the soldier frequently purchased these drinks in bazaars and villages.

He was not satisfied with the system of water filtration as existing in cantonments. The Macnamera filter may be theoretically perfect, but the filtering media for charging it is open to many objections. Charcoal and sand for the purpose was obtained from the Commissariat Department. The requisition, after being passed by the officer in charge, was sent for compliance to one of the subordinates, who passed it to the Babu, who passed it to some one else, until it came into the hands of a coolie, who collected the sand from the nearest river-bed. It was open to any one to satisfy himself as to the impurity of sand so supplied; after washing for several hours, probably, sufficiently pure sand could be obtained. He asked if this was ever carried out in barracks. Could it be carried out on field service in McDermot filter supplied for the use of troops and hospitals?

He well remembered the late Lord Napier of Magdala, during one of his inspections, ordering an analysis of the filtered water from the old-fashioned *chattie* filter, with the result that the filtered water was found to be more impure than the unfiltered water in the upper *chattie.*

He believed that in many cases the filtered water from the Macnamara filter would give the same result.

Surgeon-Major A. M. Davies, A. M. S., agreed with all that had been said by Surgeon-Major Ranking as to the diffusion of enteric fever. With regard especially to the pollution of *soil* by enteric stools, he considered that the present system of disposal of excreta was fraught with great danger; it was extremely doubtful whether the disinfection, as practised, of the stools of patients known to be suffering from the disease was in all cases effectual; and in cases not yet diagnosed as such, this inefficiency was probably greater. Sterilisation by heat would be the best method. Even then the soil would be polluted by stools of patients passed before their admission to hospital. As to infection by *milk*, it was to be feared that so long as regimental dairies are conducted in such a way as to allow of the entrance of milk from the bazaar, either for drinking or for butter-making, infection from this source would be not only possible but probable. Nothing short of complete European supervision of the feeding, watering, and milking of the cows, and absolute exclusion of bazaar milk, could make a dairy entitled properly to be called a regimental dairy; otherwise it was a delusion and a snare, the more dangerous, because a false feeling of security was produced by the name. As to incidence of enteric fever on *teetotalers*, or, more correctly, on men belonging to the Temperance Association, so far the figures obtainable did seem to show that there was a greater liability in these men to the disease. No one could suppose that this was due to their abstinence from alcohol; and, perhaps, it was not so much that they drink more water than non-abstainers, or that the food-supplies partaken of by them (in the Temperance Room) were not always above suspicion. A small epidemic lately seemed to be due to cakes, supplied only to Temperance men, and baked under filthy conditions. It had been recently shown that the heat of ordinary baking does not suffice to destroy pathoginic bacteria in every case: bread, cakes, etc., must therefore be looked on as possible sources of infection, and the water employed in their preparation carefully protected from pollution. With regard to *filters*, the Macnamara filter was complicated and unsatisfactory, and as at present used, of only slight advantage, if any, in the purification of water. It was in no sense a purifier as regards bacteria, and although animal charcoal was a powerful oxidiser, its power was not lasting, and the charcoal should be reburnt more often than was the case. The supervision of the working of the filter also required more care than was at present generally exercised. A Chamberland filter would be preferable in almost every way. *Fatigue* was a likely predisposing cause for enteric fever in the young and newly-arrived soldier, who was inexperienced in all measures of self-preservation from disease. The possibility of *evolution* of pathogenic properties in the typhoid bacillus was not to be lost sight of; in fact, Murchison's pathogenic theory, viewed in the light of recent bacteriological research, received fresh support, the idea of evolution being substituted for that of the *de novo* origin of the disease.

Surgeon-Captain O'Gorman said that his experience among European, as well as native, soldiers was wide, and he might claim to have a fair knowledge of their lives, their habits and customs. He did not know what theory Dr. Freyer had as to the association of enteric fever with teetotalism, or how he accounted for the supposed lesser susceptibility of non-abstainers. The statistics he had quoted were far too small for any rational conclusions to be based upon, and there was great risk in making general conclusions from particular and isolated instances. There was no single thing which alone caused enteric fever. Where we had to look for the propagation of enteric fever was the contamination of atmosphere, of soil, and of the sub-soil water. Grass farm in cantonments were one great source of such contamination. Night-soil trenching, as usually carried out, was another. When medical officer of a native cavalry and an infantry regiment in Allahabad he had occasion to bring frequently to notice that the *dhobis* washed the clothes of European soldiers in the foulest ponds, black and bubbling with decomposition, and with catchment areas distinctly fæcally contaminable, and also receiving the drainage from the bazaar. It should be more widely known that the *dhobis* in Calcutta and all over India wash and bleach clothes in the urine of horses and other animals, and this was another suggestion as to the propagation of disease. The milk supervision, even when nominally European, in regiments, was very defective and unreliable. As regards abstainers, he presumed the suggestion was that they were thirstier and drank more than non-abstainers, and consequently laid themselves more open to attack. This he thought was not correct. The natives of this country were abstainers and they could do an immense amount of physical labour without exhibiting distress for want of water. *Palki* and *doolie* bearers, travelling villagers, *shikaris* and mountaineers in the hottest weather never experience half the thirst that Europeans and non-abstainers did. Again, as regards aërated waters, it was a question whether the enteric bacillus could live, thrive, and multiply in an atmosphere of carbonic acid and under the pressure at which it existed in such waters. The acid, again, of lemonade and the like might not be conducive to its life. Certainly it had been shewn recently that citric acid and probably tartaric acid destroyed cholera germs, and he presumed the enteric germ would also suffer, so that these acidulated waters would be beneficial rather than otherwise. When civil surgeon of Midnapore during the last year he had had the opportunity of introducing various sanitary improvements connected with the water-supply in the Central Jail (population 900). The great defect was boiling the water before filtration, and the consequence was partly due to this that an epidemic of bowel disorder broke out, and the mortality rose higher than in some previous years.

Recently Larymore's boiler had been introduced, which announces by sounding a whistle that the water has reached boiling point; since its introduction, though not altogether due to it, the sickness and mortality lists had decreased wonderfully. Herein lay a suggestion for introducing boiling arrangements for water prior to filtration in the barracks of European soldiers. The general excreta of the jail were thoroughly intermixed with dry earth previous to trenching, and all the hospital excreta were removed through a separate opening and cremated. Strange to say, the sweepers were never ill, and were among the healthiest and strongest in the jail. The plan of burying excreta in deep trenches, where neither the air nor the sun can affect it, was much to be condemned. He had seen two cases of enteric fever in natives, one in a girl, aged ten, with very typical temperature, and the other in a sepoy with hæmorrhage from the bowel. In neither was there any eruption. Both recovered.

Surgeon-Major Tuohy, in reply to a question, said that as the thermometer in the institution was broken, he had no means of knowing positively that the temperature remained from 6-30 to 10-45 P.M. between 112° and 111°2′ F., but there was no question that on subsequent occasions the temperature often was between 117° and 114°F. for twenty minutes or more, and it was just a question if such a temperature for even such a short time several times repeated would not have as dangerous an effect on the nervous centres as a temperature of 111° or 112°F. for four hours. His own experience of hyperpyrexia only extended to three other cases: One, in typhoid fever, the temperature went up to 109°F., with death in four hours; the second, in a case of intermittent fever, where the temperature rose to 108°F., with death in eleven hours; and the third, in a case of sunstroke, when the temperature went to 109°F., with death in under an hour. The two former cases were Europeans, in both of whom active hydropathic measures were taken within, in the first case, one hour, and, in the latter, in about one-and-a-half hours from the onset of the hyperpyrexia without influencing the fatal result.

SUGGESTIONS FOR A NEW CLASSIFICATION OF THE INDIAN FEVERS.

BY RONALD ROSS,

Surgeon-Major, I. M. S.

THE opportunity afforded by the holding of the first Medical Congress in India, following, as it does, the universal acceptation of the great discovery of M. Laveran, should not be lost, I think, for pressing upon the profession the necessity which exists for a reform in our ideas, our classification, and our treatment of Indian fevers. By the Indian fevers I mean those which are usually returned under the two heads of malarial and simple continued fever. The subject is, perhaps, the most important one in the whole range of tropical medicine. In the year 1892, for example, these fevers caused the death of more than four-and-a-half millions of people in India, that is to say, six times the number of deaths caused by cholera, twelve times the number caused by dysentery and diarrhœa together, and no less than two-thirds of the total of deaths in the country. The admissions in the army and the public jails numbered no less than 43 per cent. of all the admissions put together. Yet, in spite of this frightful sickness and mortality, not much has been done toward obtaining a more scientific knowledge of these diseases. Our classification of them instituted many years ago, even before the time of Martin and Maclean, even before the discovery of typhoid fever, is now fully admitted to be very unsatisfactory, while our treatment remains in consequence formal and often perhaps incorrect. The real truth appears to be that, under the heads of malarial and continued fever, a number of diseases, which may be of quite different origins, have to be returned. It is not very long since that Surgeon-General Rice, writing in the sanitary report of the Government of India, reminded us forcibly of this fact: "The anomalous clinical and pathological character of Indian fevers," he says, "raises the suspicion that much remains still to be done in differentiation of them. As happened in the case of typhus and typhoid in Europe, a time may come when men will wonder how certain Indian fevers came to be confused one with another and lumped together. Though medical officers are obliged to return all cases of fever under one or other of the headings laid down in the official nomenclature, they are not bound to classify them in exactly the same way in their heads."

Nothing but confusion and error, I venture to say, can arise from a system where we are compelled to think one thing and to certify another. Undoubtedly our classification ought to be revised, as soon as possible, into some accordance with modern discoveries and thoughts. Before, however, proceeding to suggest how this can best be done, I will venture to discuss two great sources of error or misapprehension which, it has long appeared to me, have chiefly hindered advance in the subject. I mean first the reckless use of the word "malaria;" and, secondly, the fallacy of a system of classification founded on mere thermometric types of fever, such as continued fever, remittent fever, and febricula.

1.—ABUSE OF THE WORD "MALARIA."

By the term "malarial fever" most people understand merely a fever or a disease of a certain type. Unfortunately, however, the word implies more than this ; it implies that the fever of that type has been *caused* in a certain definite way. When we call intermittent and remittant fevers "malarial," we imply that they are due to a specific poison which is diffused in the air or water of a locality. Now, what is precisely the nature of the idea which lies at the bottom of our definitions of this malarious poison ? In what respect does a malarious poison differ from another—zymotic poison for instance? When we come to sift the question carefully in our minds, we shall see that we mean by malaria, a poison which is not communicated from man to man, but which emanates spontaneously from the soil or from the vegetation of the locality. By a malarious jungle or marsh, we mean one which is capable of infecting men with a specific poison of its own spontaneous production. A perfectly uninhabited country, for instance, may, we imagine, be malarious. Unlike the poison of cholera or typhoid, that of malaria is not supposed to be conveyed by previously infected persons; unlike that of small-pox or scarlatina it is not supposed to be propagated by direct contagion ; unlike filariæ and other entozoa, it is not supposed to pass from man to man through an intermedial host. In short, by malaria, we mean a *spontaneous* endemic poison, not a *derivative* endemic one ; and the distinction is of the utmost importance in theoretical, practical, and preventive medicine. For instance, when we see in the annual sanitary return that no less than 43 per cent. of the total sickness in India was caused by malaria, we understand that this truly terrible amount of disease was due simply to a spontaneous poisonous product of the soil, by no means a poison derived from filth, sewage, or simple contagion.

Such is the strict definition of the word malaria, and such is the conclusion we find ourselves landed in when we apply it strictly to our statistics. Fortunately, it may be seriously contested whether all the cases of fever which are now returned under the head of ague are malarial at all. It is, indeed, very possible that such a spontaneous endemic poison, as we call malaria, does exist ; but those who imagine that its existence has been definitely demonstrated are mistaken. The theory of the malarial origin, in the above sense, of any fever, has not yet been proved ; it is still under discussion. It cannot be said that our knowledge of the cause of fevers in this country is either so exact or so certain as to warrant us in stating that the majority of them are due to a spontaneous poison rather than to one which has been introduced into drinking water, say, by a previously infected person. Suppose, for example, that a regiment is quartered on active service in some remote jungle village, where it is attacked by fever ; how are we to decide whether the disease is due to a spontaneous endemic poison or to a pollution of the drinking water by generations of the inhabitants of the place ? Again, a ship goes to a tropical port and the men are seized with fever ; but how are we to know whether it is due to a malarious wind blowing off shore, or to the milk, water and vegetables which are almost always supplied to the crew as soon as the ship casts anchor. Such cases are continually cited to prove the existence of a true malaria poison ; but, evidently, a most searching analysis is required in order to come at the exact truth. Are such investigations numerous enough to enable us to pronounce so distinctly on the matter as to consider malaria responsible for nearly half the sickness in the country ? I do not think so. Consider now that form of Indian fever in which we actually know the pathogenic organism—I mean Laveran's disease. The parasite has not yet been found either in air or in water ; it is not yet known to possess any stage in its life-history during which it occupies an intermedial host, and we cannot cultivate it with facility as we ought to be able to do if it grows naturally on decaying vegetation. On the contrary, it is shown by experiment to be communicable directly from man to man. In short, Laveran's disease, which has now been shown to be synonymous with most forms of intermittent fever, has not yet been proved to be a *malarial fever at all ;* and the same applies with greater force to those other fevers of which we really know so little that we may confess to knowing nothing. Of course malaria may, and probably does, exist. What I mean to say is that we have no right yet to make its existence one of the axioms of medical science ; we have no right to apply the word yet to the vast majority of Indian fevers, nor, on strength of it, to pour in our quinine and sit down to await the result. At present the term is so much abused that instead of endeavouring to discover the real cause in every case, as we ought to do, we satisfy ourselves too often with writing "malarial fever" on the bed-head ticket.

2.—FALLACY OF A CLASSIFICATION FOUNDED ON MERE THERMOMETRIC TYPES.

The weakness of the present system of classification cannot be exibited better than by asking a single question. It is this : If intermittent and remittent fevers are malarial, why are not continued fevers and febriculæ ? By what powers of reasoning or investigation are we enabled to make such a distinction ? Obviously a continued fever has, so far as we know, just as much right to be considered a malarial fever as a remittent or even intermittent fever has. But to go beyond this, it may be doubted whether we can base any useful classification on such types as these. Putting aside true cases of intermittent, the other fevers are seen to be so much confused together that such a classification is impracticable in the majority of cases, even if it were advisable. It is very difficult to draw any hard-and-fast line between continued fevers, remittent fevers, and even some fevers of quotidian ague. Looking over my own collection of cases, I find it very difficult to state, even now that the cases are finished and complete, which belonged to any particular class. While the cases were in progress, it was generally quite impossible to do so. With respect to those fevers, which last only a day or two, and which, nevertheless, make up the bulk of admissions, it is simply impossible to decide by the chart alone whether they are febriculæ or short attacks of ague. Medical officers, in fact, return them just as they please. Nor are we much helped by a consideration of such secondary symptoms, as rigors, enlarged spleen, and intestinal symptoms, none of which are found affiliated very exactly with any particular type of fever. These things are a matter of universal experience in India. Every day we see cases so irregular or so brief that it is not practicable to classify them in the manner suggested by the official nomenclature. It is all very well to say that we ought to arrange them under one or other of the headings given there, but the thing cannot be done ; it is impossible. Sometimes, it is true, we get a typical case, but in the majority of instances we are left simply at a loss how to decide. Supposing, however, such a classification to be practicable, is it to be recommended in theory ? It is not necessary to say much on this score, for it is always possible that two cases which present very similar charts may have different causes, while others which present different charts may have the same cause. In fact, a classification founded on mere thermometric types is not nearly either precise or trustworthy enough to be of any practical or theoretical use.

3.—The True Principle of Classification.

The discovery of Laveran enables us to divide the Indian fevers at once into two great groups : those which show the parasite in the blood and those which do not. It is necessary to refer to the work which has already been done in India in this direction. In 1887 Dr. Vandyke Carter confirmed Laveran's discovery for this country. He made a careful analysis of seventy-seven cases of ague, remittent and continued fever, out of which nine only, or 11·7 per cent. were found to have the parasite, a very small percentage. At that time, however, the theory had not undergone the development it has since reached, so that the numbers may be well too small. Following Carter, several essays have appeared on the subject, in which unfortunately the results have been entirely vitiated by certain errors of identification. Objects have been described as forms of the parasite which have no relation to it, but which have led to the startling assertion that 87 per cent. of all our fevers are due to it. These results have been even accepted in Europe in some quarters, but should be guarded against as giving a very erroneous view of the real state of the case. Photomicrographs illustrating many of the pseudo-parasites were shown by the author. Dr. Carter's essay remains then the most trustworthy work which has yet appeared in India on the subject. Many think that his estimate is a great deal too small, because almost every case which arrives in Europe from India contains the parasite. It may happen, however, that those slighter cases of fever, which fill our hospitals in India, and which, perhaps, are not cases of Laveran's disease, recover during the voyage home. It is needless to say that the question is of such paramount importance that until it is answered, further progress in the subject will be out of the question.

Suppose then that Carter's estimate is right, and that 12 per cent. of our fevers are due to Laveran's disease, how are the others, we may ask, to be dealt with and classified ? There is only one sound principle to go upon, and that is, a general study of *all* the symptoms which a given case presents. The ideas concerning malaria must be laid aside, together with all trust upon the thermometric types. I myself have taken much interest in the subject for many years, and have done everything in my power to obtain some clue which may enable us to reach some useful classification. The actual causes are, of course, probably multifarious. Some of the fevers have been attributed to Carter's form of intestinal ulceration, others to abortive or a typical typhoid, others to the toxic effect of the bacillus coli and the typhoid bacillus, and so on. I think, however, that we can divide these fevers into two well-marked classes without referring to any theoretical considerations. The division is certainly very useful in practice, and depends upon the presence or absence of such *intestinal symptoms* as abdominal tenderness, tympanitis, diarrhœa and pultacious stools. They are found in so many cases and are often so acute and permanent as to strike us with the thought that the real disease may lie *here*, and that the fever may be due to some morbid process in the intestines. Those cases of fever then, which are not due to Laveran's parasite, and which show *any* intestinal symptoms, should, I am inclined to think, be treated as if they were intestinal diseases. There are many facts which point in this direction, such as the well-known connection of tropical fevers with diarrhœa and dysentery, the wonderful prevalence of intestinal worms in India, the powerful effect of purgatives in these diseases. In 1892 and 1893 I made a long series of observations upon the usefulness of intestinal treatment and careful dieting upon such cases of fever, occurring both among natives and Europeans. It is difficult, of course, to reach definite results in this manner ; but, on the whole, I think that such a course of treatment is certainly preferable to the simple quinine treatment. The following curious fact points the same way. Considering the coarseness of Indian food and the badness of Indian water, we should expect a much greater degree of enteritis, typhlitis, and colitis in this country than in England, just as there is undoubtedly more diarrhœa and dysentery But wha is the case ? On a study of statistics I find that th mortality is actually greater in England, while in St. Bartholomew's Hospital in 1892, *ten times* as many cases per cent. were admitted for these diseases as were admitted in the army and jails in India. This fact merely suggests that a large number of cases of enteritis in this country are returned under some other head, probably ague. I have little doubt that many of our so-called febriculæ are only instances of catarrhal enteritis.

4.—Proposed Alterations in the Classification.

The approaching decennial revision of the nomenclature will, let us hope, give us a better classification. The only one practicable seems to be the following:—

Under heading 23, "malarial fever" should be changed into Laveran's disease, or some equivalent, which should clearly express that only cases which are caused by the parasite should be entered here.

Under heading 16, "simple continued fever" should be changed into "fever" without any qualifying phrase, but with the following sub-headings: (*a*) fever with intestinal symptoms; (*b*) fever with enlarged spleen; (*c*) fever with other concurrent symptoms (specifying them); (*d*) fever without any concurrent symptoms. The word "fever" should be defined as "fever which is not clearly of the nature of any other fever given in the nomenclature."

In conclusion, I hope that the great opportunity of the first Congress in India will be taken to urge upon the authorities the necessity for recognising Laveran's discovery in the official statistics and returns. If it be impossible to introduce Laveran's disease at once into the nomenclature, it should at least be ordered that the name "malarial fever" shall be applied only to those cases in which the parasite is found in the blood. Though, I suppose, it will be a long time before the confusion attending our present ideas on Indian fevers are swept away, it is none too soon now that the discovery has been made for fourteen years, that medical officers should be encouraged to examine the blood in all fever cases. The official recognition of the parasite will mark a new era in our treatment, understanding, and classification of these diseases, and will show at least that we are alive to the value of so great a discovery.

NOTE ON THE DIAGNOSIS OF INDIAN FEVERS.

BY G. HARRISON YOUNGE, F.R., C.S.I.,
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Even a cursory study of the able reports of the Sanitary Commissioners with the Government of India is sufficient to show the marked differences of opinion which exist amongst medical officers on the subject of Indian fevers. A perusal of these reports—containing, as they do, extracts from the annual returns of medical officers throughout India—shows clearly that many fever cases, which, in one station, are diagnosed as enteric, are, in a second, returned as remittent, and, in a third, as simple continued fever. Under these circumstances it is both interesting and important to consider the causes which occasion these differences of opinion.

1. The first and most important of these would appear to be the absence of a definite conception as to the clinical history of simple continued fever. If an examination of notes and temperature charts is made, it will be found that the majority of cases of so-called simple continued fever extend over periods varying from three to six weeks, and that some of them present one or more relapses. The following extract from an annual return of sick illustrates this in concise and forcible language: "Some of the cases shown as simple continued fever were probably cases of enteric, but they were of such doubtful character that the disease was not changed. Some of them were exceedingly severe and prolonged, but at no time presented the clear and undoubted symptoms of enteric fever, such as diarrhœa, spots, abdominal tenderness, and the temperatures were, in some cases, very irregular and peculiar, so that only those cases are shown as enteric fever in which the symptoms were characteristic and the diagnosis certain."

Febriculæ or simple continued fever is defined in Quain's Dictionary of Medicine as "simple fever of one or not more than a few days' duration: not attended by any definite organic lesion;" and in the nomenclature of diseases as "continued fever having no obvious distinguishing character." It is difficult to see how cases, which extend from three to six weeks, which are exceedingly severe and prolonged, or which present marked intestinal ulceration, can be included under these definitions. If scientific terms are to have any value whatever, the name "simple continued" must be restricted to those cases of fever which are caused by exposure to heat or cold, which are unattended by any special lesion, and which terminate in from one to six or seven days.

2. It is customary with many medical officers in India not to return fever cases as enteric, unless the symptoms are absolutely pathognomic. Whilst freely admitting that the clinical history of all other diseases may present great, and oftentimes startling, variations, they deny a similar liberty to enteric fever. They will admit, for instance, that small-pox may occur without the intense lumbar pain, without the nausea and vomiting, without the pustular eruption; that scarlatina may exist without the sore-throat, without the scarlet rash, without the desquamation; that pneumonia may be present without the cough, without the rusty expectoration, without any of its distinctive physical signs, and so on throughout the whole nomenclature of diseases. And, yet, whilst allowing the possibility of marked variations in all other diseases, they deny a like possibility in the case of enteric fever. Distinguished as are the names of many of those who have supported this opinion, I cannot but differ from them; for experience in India has taught me that the clinical history of the majority of cases of enteric fever varies within, by no means, narrow limits, and that it is exceptional to see a case which presents all the classical symptoms. Indeed, it is difficult to see on what grounds

the opinion that enteric fever must present—a never varying clinical history is founded. It would be as logical to suppose that all the children, begotten of the same parents, must of necessity resemble each other in character, disposition, and features, as that all the cases of enteric fever must present precisely the same symptoms. All the children of a family spring from the same germinal vesicles, as do all the cases of enteric fever spring from the same genus of specific poison. Even in the largest human families, each member may differ widely both in disposition and features from his brothers and sisters, but we would not on those grounds maintain that they could not belong to the same family. In the same way cases of enteric fever, both in the tropics and in temperate climates, often differ remarkably from the family type, but we should not on that account refuse to give them their proper name.

3. An opinion is still prevalent in India that ulceration of Peyer's patches may occur in other diseases than enteric fever. This is very clearly shown in a report on eight fatal cases of fever amongst natives. The lesions found in the intestines are variously described as follows: "Peyer's patches were much enlarged; several were ulcerated, three so deeply that perforation seemed imminent." "Solitary glands and Peyer's patches of the small intestines ulcerated. The ulcers of many of the patches were deep, and penetrated in a few to the peritoneal coat." "Almost all Peyer's patches were highly congested, ulcerated, and appeared like nodules," and so on. And yet, it is stated, in conformation of the fact, that typhoid is not prevalent amongst natives, that "from a perusal of the *post-mortem* records, he believed that the *post mortem* appearances would in no case prove that any one of the deaths was due to the specific form of continued fever, known as typhoid or enteric." In the words of the late Dr. Hilton Fagge, however, " no other specific disease is accompanied by a definite series of internal lesions, which, being peculiar to it, constitute a certain test of its presence in all cases that end fatally. It is on account of the importance of these lesions, and also because I wish to mark the distinction which is created by them between enteric fever and the various diseases with which it is closely allied, that I describe them before entering on the clinical symptoms and course of the disease."

4. The characters of the intestinal ulceration, as seen in England and in India, differ considerably, and this fact has been advanced as a proof that the enteric fever of the tropics is a different disease from the enteric fever of temperate climates. In temperate climates, for instance, the ulcers are small and elliptical, and present clean cut edges, which are neither thickened nor congested. In the tropics, the ulcers are often large and irregular in shape, with everted, thickened, ragged, and discoloured edges. A simple analogy, however, will show the course of this difference. Compare the ordinary cutaneous boils of England with those crops of cutaneous boils which are so common in India during the hot season. In the former there is a trifling elevation, which contains a single drop of laudable pus, and which heals immediately on the evacuation of its contents. In the latter there is a considerable cavity, which is filled with altered blood-clots and with dark-coloured sloughs of connective tissue; whilst the edges of the irregular opening through which the contents escape are thickened, inflamed and dusky, and show little tendency to granulate or heal. The difference is due to the fact that in Europeans exposure to a tropical climate not infrequently begets a state of the system which is in the highest degree favourable to the occurrence of necrotic changes in the tissues, and which is equally antagonistic to the process of repair. It is this condition of the system which, on the one hand, aggravates the cutaneous boils, and, on the other, produces the striking variations in enteric ulcers. In some cases the ulceration is so extensive that almost the entire mucus membrane for two or three inches above the ileo-cæcal valve is destroyed, only isolated, irregular and more or less ragged islands of the membrane remaining intact. In cases of this kind I have always found the gums swollen, spongy, and of a dusky colour, showing the presence of a scorbutic taint, and it is more than probable that this taint was at the bottom of the excessive and anomalous ulceration.

5. There are two symptoms, namely, rose-coloured spots and "pea-soup" diarrhœa, which are always looked for in suspected cases of enteric fever, and which, when present, are considered pathognomic of the disease. In India the absence of those symptoms is frequently accepted as conclusive proof that the patient is not suffering from enteric fever. Even in temperate climates, however, many undoubted cases of typhoid occur, in which neither of them is present. In tropical enteric fever, rose-coloured spots are frequently absent, and, even when present, it may be impossible to recognise them, owing to the co-existence of " prickly heat." On the other hand, typical pea-soup diarrhœa is rarely, if ever, seen. In the majority of cases, the stools are of a dull, yellow colour, closely resembling freshly-made mustard in appearance. They are usually semi-solid, and do not separate into two strata. In other cases the stools consist of a dark, greenish, black fluid, in which small, bright yellow particles are seen to float. On standing these particles fall to the bottom, and may easily escape detection. After the first week the latter form of diarrhœa may cease altogether, being replaced by constipation, but more frequently it passes into the first variety. Occasionally severe cases of enteric fever occur, and prove rapidly fatal, in which the motions remain bilious from first to last. In others constipation may be present throughout the whole illness, but when this exists, the motions are probably always of a mustard colour.

6. In temperate climates, the course of the temperature is so uniform that the typical charts of Murchison and Wunderlich are valuable guides in the diagnosis of enteric fever. If these charts are applied to the disease as seen in India, however, they become in the highest degree misleading, as the course of the temperature differs very remarkably from them. The

daily increase of 1° in the temperature for the first four or five days, which is so characteristic of typhoid in temperate climates, is a rare exception in the tropics. When the cases occur during the hot season, the temperature on the first evening of observation may be the highest recorded throughout the attack; when during the cold, it may be intermittent for several days. Occasionally, in mild cases, it is even possible for the temperature to remain intermittent during the whole illness. Nay, further, I am informed by Dr. W. S. Harrison that, during a recent extensive outbreak of typhoid in Lancashire, he saw an undoubted case of the disease, in which the temperature throughout was *sub-normal* (varying for 96° to 97°F.), and in which the first sign of improvement was a rise to the normal standard.

If asked to name the most distinctive peculiarity of tropical enteric fever, I should feel disposed to answer: The erraticity of its temperature. In uncomplicated cases a marked morning remission is the rule, but the degree of remission is subject to almost daily variations. Occasionally, without any apparent cause, the remission does not occur, so that for one or two days the morning may equal, or may even exceed, the evening temperature. Sudden and marked falls are of not infrequent occurrence, and do not possess the same grave significance as in temperate climates. After these falls the temperature often takes twenty-four to forty-eight hours to regain its original position, so that, instead of an abrupt ascent, the chart presents a graceful curve. Viewed as a whole, however, the charts not infrequently present a series of rhythmical irregularities, which are very peculiar, and, I believe, distinctive of tropical enteric fever.

In a well-known and popular work on tropical diseases, it is stated, that in climatic fevers "there may be all the symptoms of typhoid except the fever being of a remittent type." From the context, this sentence can only mean that fever cases, which present a remittent temperature, cannot be enteric, however characteristic the other symptoms may be. Taken in this sense the statement is in the highest degree surprising, and for this reason, namely, that enteric fever is *par excellence* the remittent fever, in that, except when modified by the presence of complications, the temperature shows a marked morning remission (sometimes amounting to 3° or even 4°F.) with an evening exacerbation. As the case progresses towards recovery the morning remissions become more distinct, whilst the evening exacerbations become less marked. The remissions increase until the morning temperature becomes normal. When this occurs we get an intermittent temperature, so that anyone looking at the chart for the last five or six days only might easily believe the case to have been one of ague. Of course, there are many exceptions, but this is the rule even in temperate climates. "This *intermittent* type of pyrexia is so characteristic (of enteric fever) that I have known a correct diagnosis based on it alone" (Hilton Fagge). And, yet, the fact that the temperature becomes intermittent during the last week has been brought forward as a proof that the disease as seen in India is not genuine enteric fever.

7. In studying Indian fevers we have unfortunately fallen into the habit of arguing that certain cases cannot be enteric because of the absence of one or two pathognomic symptoms. Instead of reasoning in this way, however, we should rather conclude that these cases are enteric, because they present a certain well-defined, though modified, course which is known to be characteristic of the disease in India, and because fatal cases of the kind invariably exhibit ulceration of Peyer's patches.

Those of us who have to deal with European troops will be greatly assisted in the diagnosis by the fact that in healthy cantonments, from which every source of malaria has been as far as possible eradicated, remittent fever is an uncommon disease, whilst genuine simple continued fever does not extend beyond six or seven days.

In the case of a European, and especially of one who has not been more than two or three years in India, who has had fever of a remittent or continued type for any period exceeding seven days—whose face presents a slight dusky flush most marked over the malar regions—whose tongue is ether universally red, or red at the tip and edges, and slightly furred on the dorsum—who has some enlargement of the spleen and tympanites, however slight, we may feel absolutely certain that he is suffering from ulceration of Peyer's patches.* *And having ulceration of Peyer's patches he has enteric fever, for that is the only acute febrile disease which presents this special lesion.*

In the abstract the diagnosis of Indian fevers may, perhaps, appear a matter of comparatively little moment; for by whatever name the cases are returned the broad principles of treatment remain the same. In reality, however, the question is one of vital importance, for as long as our present attitude towards fever cases is maintained, many cases of enteric will be annually returned as remittent or as simple continued fever, with the result that strict personal sanitary precautions will be more or less completely neglected, and that the germs of a fell disease will be allowed to multiply unchecked.

ON THE TREATMENT OF SYPHILIS BY THE INTRA-MUSCULAR INJECTION OF MERCURY.

BY R. L. LOVE, B.A., M.D.,
Surgeon Major, A. M. S.

Now that the power to prevent the spread of syphilis among our soldiers, by the only rational method we know, has been taken away from us by our legislators, it is incumbent on us to try and improve the treatment of the disease when we meet it face to face—a frequent occurrence in the service.

If the very long time most cases of syphilis spend in hospital could be made shorter with equally good, if not better, results—if the great number invalided for syphilis could be reduced—then it must be admitted that the method of treatment by which this is accomplished is a great improvement on all other methods.

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* In the malarious districts of Burma, however, we still meet with a severe form of malarial remittent in which it is oftentimes impossible to arrive at a correct diagnosis until the cases have been under observation for at least ten days or a fortnight.

This form of treatment, which I propose bringing to your notice, has been practised on the Continent and at home for some time. My attention was drawn to a paper in the Army Medical Department Report for 1891 on the subject, and, from the good results obtained by the writer of the paper in his practice, I determined to give it a trial.

Since April last I have treated every case of syphilis, recent and chronic, that has reported himself at hospital by the hypodermic injection of mercury. At the outset two difficulties in the carrying out of the treatment gave me some trouble to overcome. One was how best to prepare the ingredients to be injected; the other, what was the best kind of syringe to use. After many trials, I found that a suitable mercurial cream could be made by rubbing in a glass mortar from one to two hours, at a temperature of 70° to 90° F., one drachm mercury and two drachms pure lanolin; then I add two drachms pure olive oil, sterilised by heat and allowed to cool; the whole is then well rubbed up for another hour, when a cream is formed, which drips tenaciously from a glass rod dipped into it. If the cream is too thick, it refuses to pass through the needle of the syringe; if too thin, the mercury subsides to the bottom of the vessel, and no amount of stirring will intimately mix it with the other ingredients.

The second difficulty was to procure a suitable syringe; the ordinary hypodermic syringe used for injecting drugs, of which water is the vehicle, is too fragile, and the lumen of the needle too small for this purpose.

I have, however, found a syringe which answers my purpose. The needles are of steel, strong, and about twice as large in the lumen as the ordinary one; they are about 1½ inch in length. The syringe is strongly made, and considerable power can be applied to the piston in pressing the cream through the needle.

The *modus operandi* is as follow: I charge the syringe with a little more than the required dose of the cream, taking care that there are no air bubbles between the piston and the nozzle. I then fit on the needle and press on the piston, till the cream passes out of the needle and the required dose remains in the syringe. The needle is then rapidly inserted up to the hilt in the patient's hip; the piston is slowly pressed on till all the cream has passed through the needle; the syringe is then carefully withdrawn. The dose I begin with is ten minims, of this 20 per cent. cream. At first I injected the same dose once a week during the whole treatment. The gums of many of my patients became slightly spongy after the third or fourth injection, although all signs of syphilis had not quite disappeared. This led me to think that the dose might be too large. My practice now is to begin by injecting ten minims, and also a second time if the disease is of a virulent type; afterwards I reduce the dose if the disease is yielding to treatment. All my patients attend hospital once a week for an injection, except those who have unhealed sores or tender glands in the groins; these I admit to hospital, rest being necessary in the treatment.

As a rule, on the second day after an injection, every one complains of a little pain in the hip due to the inflammatory action set up and required for the absorption of the cream into the circulation. A hard lump, varying in size from a walnut to a hen's egg, can be felt deep among the muscles of the hip; as absorption goes on, this gradually softens and disappears. Some hypersensitive patients complain a good deal of the pain, but when I have suggested stopping the treatment, they prefer that it should go on as they easily see the benefit they are deriving from it.

When treating patients who are not in hospital, I make it a *sine quâ non* that they have plenty of good food. I limit them to one pint of beer daily taken at dinner and insist on their being warmly clad and avoid getting wet. It does them no harm to be engaged at some light duty.

When giving an injection, it is better to avoid going too close to a previous one, if this happens; on withdrawing the needle, there may be a little venous hæmorrhage, due to the highly vascular condition of the tissues at the seat of a previous injection. In none of my cases has any complication, such as abscess, followed the injections, and in all of them the hips have returned to a normal state a fortnight after the last injection was given.

All my patients, who were treated as soon as constitutional signs of syphilis made their appearance, have rapidly yielded to the treatment. As a rule, after the second injection, skin eruptions and rashes begin to disappear, and after the fourth injection have entirely gone; this also obtains with gummata, ulcers, and mucous patches in the mouth, condylomata, etc. In chronic cases, which have already received specific treatment, the constitutional signs do not yield so quickly. Affections of the skin never fail in clearing up; not so readily do ulcers and mucous patches on the mucous membrane, affections of the bones and other chronic signs. Affections of the mucous membrane can be helped towards recovery by local applications; the most satisfactory I have found to be solid nitrate of silver applied freely once or twice. Local applications alone will not cure this type of syphilide; it keeps frequently recurring, but if the patient is undergoing a course of injections at the same time, recurrence has not taken place in my practice.

I have succeeded in removing every sign of syphilis from all the patients I have treated, at least for the time being, with one exception, and he had only received three injections when I had to stop them, owing to his getting a bad attack of malarial fever. During the period he was getting the injections, the signs of syphilis appeared to be yielding. After he recovered from the fever the syphilis had become worse to an alarming extent, and he was so emaciated and anæmic that I did not consider it advisable to resume the injection. He died some time after; his fauces and tongue were one inseparable putrid mass, the lower jaw in the right side was denuded of periosteum, all the internal organs stank abominably, there was a large putrid slough on one of the kidneys.

The conclusion I have come to after seven months experience of this treatment are : (1.) The administration of mercury by hypodermic injection is followed by better and quicker results than by any other method. (2.) Where formerly syphilitic cases spent three to six months in hospital, the majority of them are treated without being admitted to hospital, and four to eight weeks course is sufficient in nearly every case to remove all signs of syphilis. (3.) As far as my experience goes, the patients thoroughly believe in this treatment, and they much prefer attending hospital once a week for an injection to remaining in hospital during the treatment.

Practical Hints.—Every one should attend himself to the toilet of his syringe and needles. By doing so in an intelligent way, there is no such thing as needles becoming rusty and blunt at the point, and a well made syringe getting out of order.

When the thermometer falls below 60° F., the cream solidifies. This can be remedied by putting the vessel containing the cream into another vessel containing water at 90° F., and stirring up the cream vigorously with a glass rod. It will soon come to the proper consistence for injecting.

(*For tabulated Statement see pp. 397 and 398*).

HYPODERMIC INJECTION OF MERCURY.

BY G. H. LE MOTTEE,
Surgeon-Major, A. M. S.

When attending a course of post-graduate lectures at Charing Cross Hospital, during the winter session of 1887-88, in company with several other army medical officers who were stationed with me at Aldershot, a very interesting lecture on syphilis was delivered by the late Mr. Ashley Bloxam, of St. George's Hospital, in which he strongly advocated the hypodermic administration of mercury in the form of "sal alembroth." This treatment in his hands had been so satisfactory that we all concluded that it would leave nothing to be desired from a military point of view. We were, however, doomed to disappointment, for so many of those hypodermic injections, when administered at Aldershot, were followed by the formation of abscesses that this mode of treatment was speedily dropped.

This was a great disappointment to me, and I confess that when I read Surgeon-Captain Lambkin's paper in the Army Medical Department Report for the year 1891 (received January 1894), in which he recommends so strongly the use of Dr. Althus' mercurial cream, I was most sceptical. However, I took immediate steps for giving this mode of treatment a fair trial; lanolin was purchased locally (Fyzabad, Oudh), and the cream was carefully dispensed according to instructions.

The first fifteen cases were treated with the locally made cream during a period of ten weeks, and under adverse circumstances, for the injections caused considerable discomfort in the majority of the cases and distinct inflammation and pain in some of the cases. Moreover, as I only had two needles, these, after a period of about four or five weeks each, became useless, owing to the tube of the needle becoming blocked, so I was forced to discontinue this treatment.

I then determined to write to Messrs. Krohne and Sesseman, of Manchester Square, for some of their syringes and a good supply of needles, also to Messrs. Savory and Moore for some of Dr. Althus' cream. I asked the latter if they could explain why so much discomfort and so much inflammation had attended my cases, and in supplying some cream of their own make they remarked: "The proportion of mercury is 1 in 10. The proportion in the formula, which you have been using, is 1 in 4, and this may possibly account for the inflammation which you have found it set up. The cream needs very careful preparation. The mercury must be absolutely 'killed' before the carbolic oil is added, and this means at least from 1½ to 2 hours continuous rubbing." With my new supply of cream, syringes and needles, I commenced the second series of cases, and the results, as far as the administration of mercury alone is concerned (*vide* tables of cases appended), leave nothing to be desired for.

1. The patients (except those who had to be confined to bed with primary sore or bubo) enjoyed good health in barracks, merely losing one hour a week when they attended hospital for injection.

2. The services of these men, who, in the ordinary course of events, would have been in hospital about two months each, were secured for duty, *i.e.*, to the benefit of the state, and the benefit of their comrades by lightening the guard duties of the latter.

A tabulated list of the cases, in order of sequence, with the results, will be found on pp. 399 and 400, from which it will be observed that—

1. There has been practically no more discomfort attending the mercurial injection beyond what might be expected from injecting distilled water, or the mere insertion of a clean needle under the skin, and I may add in those cases confined to bed even this slight discomfort was hardly ever complained of.

2. With one exception there has been no salivation (*vide* No. 13 of second series), even in the severe cases where it was considered advisable to inject twice a week.

In conclusion, I would remark that I have entered into the details of the adverse circumstances attending my earlier cases, in order that any one wishing to try this treatment may learn by my misfortunes, and take steps to provide himself with satisfactory appliances and materials, otherwise he may too hastily condemn a mode of treatment which, I feel sure, if carried out strictly in detail, will prove, not only satisfactory, but superior to, and certainly more simple than, any other mode of mercurial administration. I use the term "superior" advisedly, for it will be seen on reference to the tables that the symptoms yielded more readily than is usual when the mercury has been given by mouth, and that in some of the cases where the drug had been thus given over long periods, apparently without much success, the symptoms yielded readily to the hypodermic injections.

TWELVE CASES TABULATED.

Class.	Duration of case previous to first injection.	Whether treated by mercury or iodide of potassium previously.	Number of injections given. Strength of injections. Period of treatment.	Condition of patient at first injection.	Condition of patient when treatment by mercury was discontinued.	REMARKS.
1	Seven months ...	Treated with mercury by the mouth.	Four. Minims 10 Six weeks.	Copper coloured rash all over trunk and limbs. Superficial ulcers on fauces and palate.	Rash absolutely gone, ulcers healing, gums tender.	The ulcers were touched occasionally with solid nitrate of silver. He had iodide of potassium and bark for a fortnight after the injections were discontinued, and was then free from syphilis.
2	Three months ...	Treated with mercury by the mouth.	Six. All. minims 10 Six weeks.	Roseolar rash over trunk and limbs. Nostrils inflamed and discharging freely.	Rash quite gone, nose sound, gums slightly spongy.	After the injections were stopped he was free from all signs of syphilis, but as the gums were slightly affected I put him on potassium iodide and bark for a fortnight when they were sound.
3	Six months ...	Treated with mercury by the mouth.	Five. All. minims 10 Five weeks.	Faint copper coloured rash on trunk and limbs. Palate and fauces congested.	Rash quite gone, throat normal, gums slightly effected.	This case had iodide of potassium and bark for ten days after injections were stopped. The gums were then normal. I saw him five months after and found him free from syphilis.
4	Four months ...	No previous treatment by mercury or iodide of potassium.	Six. All. minims 10 Six weeks.	Ulcers on hard and soft palate. Remains of hard sore on penis, glands in groins slightly enlarged and hard.	Free from syphilis, gums not affected.	This man, a corporal, appeared for medical examination to extendhis service. I refused to pass him fit. After the treatment I passsd him fit. He had no iodide after the injections were stopped.
5	Three months ...	Treated by mercury and potassium iodide by the mouth.	Four. All. minims 10 Four weeks.	Copper coloured rash on trunk and limbs, glands in right groin enlarged and hard. The hard base of sore now healed on prepuce.	Free from syphilis, gums spongy.	After injections were stopped he had potassium iodide and bark for a fortnight, when gums were sound. The gums ulcerated afterwards, due, I think, to a scorbutic taint, and healed after suitable treatment. I examined him on 9-10-94 and found him still free from syphilis.
6	One month ...	No specific treatment.	Five. All. minims 10 Five weeks.	Very dark eruption on trunk and slightly on limbs. Hard sore on glands, penis unhealed, glands in groins enlarged and hard. Two mucous patches on right tonsil.	Free from all signs of syphilis, gums spongy.	A fortnight after the injections were stopped the gums were sound. He had no other treatment. I examined him three months after and found him still free from syphilis.
7	One month ...	No specific treatment.	Six. All. mimims 10 Six weeks.	Hard sore on glands, penis glands in right groin, hard and enlarged. A claret coloured rash all over trunk and limbs. A mucous patch on each side of the uvula.	Free from all signs of syphilis, gums not affected.	A most satisfactory case, the lad was 16 years old. I saw him three months after, and he was still free from syphilis.

TWELVE CASES TABULATED—*continued.*

Class.	Duration of case previous to first injection.	Whether treated by mercury or iodide of potassium peeviously.	Number of injections given. Strength of injections. Period of treatment.	Condition of patient at first injection.	Condition of patient when treatment by mercury was discontinued.	REMARKS.
8	Three months ...	Treated by mercury and iodide of potassium by the mouth.	Five. All. minims 10. Five weeks.	Numerous rupial sores on face, one like a horn between the eyes on the nose. Numerous mucous patches in the mouth. Several gummata on the tongue.	Free from all signs of syphilis, gums not affected.	A native driver in Mountain Battery. Mercury and iodide by the mouth and local applications failed. When the injections were commenced he had no other treatment. He is still free from syphilis.
9	Two years ...	Treated by mercury and iodide of potassium by the mouth.	Four. All. minims 10. Eight weeks.	A node as large as a turkey's egg on right clavicle, chronic pains in the knees, shins and ankles. Constant pain at the site of node.	An abscess formed over the node. When opened, dead bone was discovered. This took a month more to heal. Gums spongy. Pains in the legs quite gone.	The abscess cavity was dressed antiseptically. At each dressing pieces of dead bones came away, finally a large seqestrum was removed. The wound then healed in a week leaving the clavicle a little larger than its fellow and the man in good health and free from all pain. He had no other treatment.
10	Fourteen months	Treated by mercury by the mouth.	Four. All. minims 10. Eight weeks.	Copper coloured rash on arms, lighter shade of rash on trunk and limbs, pain in left knee which was slightly swollen.	The rash had disappeared from trunk, but not quite from limbs. Pain gone from knee. Gums slightly spongy.	I kept this man under observation for another month, but gave him no further treatment. At the end of this time, he was free from syphilis, and gums sound.
11	Two months ...	No specific treatment.	Four. One minims 10 One minims 7 Two minims 5 each. Five weeks.	Roseolar rash all over trunk and limbs. Hard soreon prepuce again broken out which had healed previously, glands in groin slightly enlarged and hard.	All signs of syphilis had gone except a slight hardness of prepuce where sore had been. Gums not affected.	I kept him under observation without any treatment for another week when he was free from all signs of syphilis.
12	Two months ...	No specific treatment.	Four. Two minims 10 each. Two minims 5 each. Six weeks.	Hard circatrix on prepuce, gland in left groin enlarged and hard roseolar rash all over trunk and limbs.	Rash gone, enlarged gland softer. Gums slightly tender.	A fortnight after the injections were discontinued this man was free from syphilis and gums sound. No other treatment was used.

First Series.

No. of case.	Name.	Form of disease.	Symptoms.	No. of injections.	Period under this treatment.	REMARKS.	Result.
1	Pte. T. ...	Secondary syphilis.	Rubeolar rash all over body for previous three weeks and ulceration of throat.	7	9-1-94 to 4-3-94	Considerable hardness over seat of 3rd injection and pain ; left for Darjeeling, 9-3-94.	No improvement.
2	Pte. W....	do. ...	Rubeolar rash all over body, sore-throat, indurated inguinal gland.	6	20-1-94 to 4-3-94	Pain and swelling over seat of 4th injection, rash disappeared after 3rd injection, no induration of gland after 4th injection ; left for Darjeeling, 9-3-94.	Marked improvement.
3	Pte. McD.	do. ...	Patches of alopecia on scalp, slight sore-throat, marked rubeolar rash over body.	5	18-1-94 to 4-3-94	Hardness, swelling and slight pain over seat of 2nd and 3rd injections ; left for Darjeeling, 9-4-94.	No improvement.
4	Pte. H....	do. ...	Serpiginous ulceration over both tonsils, slight psoriasis of palm of hands.	6	18-1-94 to 4-3-94	Great pain, hardness and swelling over seat of first injection, throat much improved, no psoriasis ; left for Darjeeling, 9-4-94.	Improved.
5	Pte. L. ...	do. ...	Rubeolar rash all over body	9	18-1-94 to 1-4-94	Great pain, hardness and swelling over seat of first three injections, but none after the others, rash disappeared after 1st injection.	Recovered.
6	Pte. M. ...	do. ...	Papular rash, slight soreness of throat ...	9	25-1-94 to 1-4-94	Hardness, but no pain after 2nd and 3rd injections, slight soreness after 4th and 5th, rash disappeared after 3rd injection.	Recovered.
7	Pte. M. ...	do. ...	Rubeolar rash all over body, soreness of throat.	9	25-1-94 to 1-4-94	Pain, hardness and swelling after first 3 injections only, rash disappeared after 3rd injection ; left for Kailana, 6-4-94.	Improved.
8	Pte. McC.	do. ...	Faint rubeolar rash over trunk, cartilaginous thickening of prepuce, ½" by ¾", over site of original chancre (25-12-93).	9	4-2-94 to 1-4-94	No hardness, no pain, etc., rash disappeared after 2nd injection, thickening reduced to size of a No. 4 shot ; left for Kailana, 6-4-94.	Recovered.
9	Pte. N. ...	do. ...	Very severe case, typical rupia over back, patches of alopecia over scalp, soreness of tongue and throat, general anæmia.	7	18-2-94 to 1-4-94	Felt sore after only one injection, has remarkably improved ; left for Kailana, 6-4-94.	Marked improvement.
10	Pte. McI.	Primary syphilis.	Site of chancre (26-12-93) indurated and liable to ulceration, no secondary symptoms.	9	25-2-94 to 22-4-94	Marked hardness, but no pain after the 7th and 8th injections.*	Improved.
11	Pte. T. ...	Primary and secondary syphilis.	Seat of chancre (4-1-94) still indurated, sectional rash had disappeared before he came under this treatment.	9	25-2-94 to 22-4 94	Felt stiff and sore (for 3 or 4 days) after seven of the injections.*	Doubtful.
12	Pte. T. ...	do. ...	Seat of chancre cartilaginous and slight rash.	8	25-2-94 to 15-4-94	Felt sore for about two days after four injections, and after a 5th there was an area of hardness about 4 square inches, seat of chancre quite soft.*	Improved.
13	Pte. K. ...	Secondary syphilis.	Condyloma ani	3	1-4-94 to 15-4-94	Felt sore for about 4 days after each injection.*	Doubtful.
14	Pte. McC.	do. ...	Has been treated in hospital with primary sore (11-2-94 to 12-4-94) secondary rash still faintly visible, and psoriasis of palms of hands.	1	15-4-94	Hardness and swelling of whole buttock.*	
15	Pte. J. ...	do ...	Marked alopecia ; has been in hospital for last 80 days.	2	15-4-94 to 23-4-94	Sore for 3 days after each injection.*	

* Treatment discontinued for want of needles and cream.

Second Series.

No. of case.	Name.	Form of disease.	Symptoms.	No. of injection.	Period under this treatment.	REMARKS.	Result.
1	Gr. N. ...	Secondary syphilis.	Marked rubeolar rash over trunk and extremities; later on, sore-throat and mucous patches on tongue.	11	18-6-94 to 28-8-94	Rash disappeared after 2nd injection, mucous-patches disappeared after 9th injection, felt sore two to five days after each injection, but symptoms were subjective only.	Recovered.
2	Pte. C. ...	do. ...	Treated for rash and sore-throat one month previously in hospital: the sore-throat alone remained.	11	18-6-94 to 27-8-94	Perfectly well after the 7th injection, felt sore two days after each injection.	Recovered.
3	Pte. K. ...	do. ...	Very severe papular and pustular eruption over trunk and extremities, and sore-throat, mucous patches on tongue and palate: had been 6 weeks under treatment in hospital.	15	18-6-94 to 16-8-94, under observation till 3-9-94.	Injected twice a week from 2-7-94 to 16-8-94, felt very little soreness after injection.	Recovered.
4	Pte. C. ...	do. ...	Circular erythematous blotches over body ...	11	18-6-94 to 27-8-94	Rash disappeared after 3rd injection, pain and swelling after two injections, but none at all after the others.	Recovered.
5	Pte. F. ...	do. ...	Treated in hospital for secondary syphilis for four weeks previously; copper coloured blotches still on fore-arms and lower extremities.	11	18-6-94 to 27-8-94	Rash disappeared after 5th injection, practically no soreness after injections.	Recovered.
6	Pte. H. ...	do. ...	Treated in hospital for 63 days for primary sore and secondary rash (14-4-94 to 15-6-94); very dark rubeolar rash over trunk and extremities.	10	18-6-94 to 27-8-94	Rash disappeared after 3rd injection, felt sore two to five days after most injections, but symptoms subjective only.	Recovered.
7	Pte. S. ...	do. ...	In hospital (16-5-94 to 15-6-94) under mercurial treatment for primary and secondary syphilis; dark rubeolar blotches on trunk and extremities.	11	18-6-94 to 27-8-94	Rash disappeared after 3rd injection, felt sore about three days after each injection, but symptoms subjective only.	Recovered.
8	Pte. H. ...	do. ...	Treated in hospital (1-5-94 to 15-6-94) for secondary syphilis, rubeolar rash, mucous patches on tongue and fauces.	9	18-6-94 to 20-8-94	Rash disappeared after 2nd injection, no soreness whatever after injections.	Recovered.
9	Pte. L. ...	do. ...	In hospital since (8-6-94) with secondary syphilis; papular rash over trunk and extremities; mucous patches on tongue and lips from 23-7-94 to 3-9-94.	12	18-6-94 to 27-8-94	Rash disappeared after 6th injection, but the injection had no influence over the mucous patches, considerable soreness after injections, but symptoms subjective only.	Improved.
10	Pte. H. ...	do. ...	In hospital (20-5-94 to 19-6-94) with secondary syphilis; dark purple rubeolar rash all over body, and a mucous patch on lip.	9	18-6-94 to 20-8-94	Rash disappeared after 2nd injection, no soreness after the injections.	Recovered.
11	Gr. W. ...	Primary and secondary syphilis.	Admitted to hospital (23-5-94) with very large hunterian chancre; rubeolar rash all over body appeared 7-7-94; a very severe case.	14	25-6-94 to 3-9-94	Injected twice a week from 6-8-94 ...	Recovered.
12	Pte. G. ...	Secondary syphilis.	Rubeolar rash over body for one week; treated himself in barracks for primary sore; no mercury given previously.	11	25-6-94 to 3-9-94	Rash disappeared after 5th injection, sore about two days after each injection.	Recovered.
13	Pte. M. ...	do. ...	Primary sore (8-2-94 to 5-7-94) very severe; mercury given, rubeolar rash over trunk and extremities, mucous patches on fauces and mouth developed.	8	9-7-94 to 27-8-94	Rash disappeared after 5th injection, slight salivation after 7th injection, slight induration over seat of one injection, no soreness at all after another, but generally sore two to four days after.	Recovered.
14	Gr. A. ...	do. ...	Papular rash on body while under treatment for primary sore.	9	9-7-94 to 3-9-94	Rash disappeared after 7th injection, no soreness after three injections, but sore two to three days after the others.	Recovered.
15	Pte. R. ...	do. ...	Treated himself in barracks for primary sore, rubeolar rash all over body for last ten days.	6	16-7-94 to 20-8-94	Rash disappeared after 5th injection, left the station after 6th injection, sore for a whole week after 1st injection, but not sore at all after the others.	Recovered.
16	Pte. G. ...	do. ...	Treated himself in barracks last January for primary sore, rupia on soles of feet and about insteps for ten days previously.	5	3-8-94 to 27-8-94	Not a test case, as patient was taking potassium iodide the whole time.	Recovered.

SYPHILIS IN INDIA.

BY PULIN CHANDRA SANYAL, M.B.

It is still a disputed point in medical history whether constitutional syphilis has existed in India from the remotest times, or whether it was imported more recently from some other country.

Now, to decide this point, we must have recourse to the Ayur Veda Sanhitas or ancient Hindoo medical works. Of these, Charaka and Susruta Sanhitas are the most ancient works which now exist, and which are regarded as the best authorities on Hindoo medicine. Professor Wilson is of opinion that Charaka and Susruta were composed during the ninth or the tenth century. But there are proofs that they were written much earlier. It is said that these two works were translated into the Arabic as early as the eighth century of the Christian era. Of these works no mention is made of syphilis in Charaka. In Susruta Sanhitas, which is the most reliable book on ancient Hindoo Surgery, a disease like syphilis is described, which is called *upadangsa.* But it may be proved that it is not our modern syphilis which Susruta describes. Several European authors, including Lancereux, affirm that syphilis existed in India from very remote times. Lancereux goes so far as to assert that Susruta, not only describes syphilis, but has even touched upon its remoter consequences upon the bones, eyes, and nose. Now these mistakes arise from an imperfect knowledge of the Ayur Veda Sanhitas on the part of European authors. Even some of the learned men of our own country confound upadangsa with syphilis, and upadangsa is generally used in this country as the native name for the disease, but this is a misnomer.

Susruta describes the disease upadangsa as follows :—

"Excessive sexual intercourse or continued sexual abstinence ; having connection with a woman who leads a religious life or who has long abstained from sexual intercourse ; or with a woman who is menstruating, or whose sexual organs are covered with long coarse hairs, or whose vaginal canal is very narrow or very capacious, or who has washed her parts with dirty water ; or with a woman whose sexual organs are diseased, or with a woman who is loathsome and excites disgust ; mechanical causes acting on the urethra, such as a piece of nail or bone, or some poisonous substance or irritant ; wound inflicted upon the penis by pressure of the hand ; washing the penis with dirty water or pressing the penis with the fingers ; withholding the desire to pass water or checking the emission of semen ; not washing the parts after copulation. Any of the foregoing causes acting on the penis excites the bad humours in the penis, and the penis swells, with or without ulceration. This swelling of the penis is called *upadangsa.* Upadangsa is of five sorts : upadangsa due to wind, upadangsa due to phlegm, upadangsa due to bile, upadangsa due to blood, and upadangsa due to all the above causes combined, *i.e., sannipatic.* In wind upadangsa, the parts are hard and cracked and dull looking, the swelling is unequal, and various kinds of pain are felt. In bilious upadangsa, there is fever, the parts are red like ripe figs, there is burning sensation, the parts suppurate soon, and pain is felt. In phlegmatic upadangsa, the parts are hard, there is itching and very little pain. In blood upadangsa, there is black colored abscess, discharge of blood, fever, burning sensation, and other signs of bilious upadangsa. This variety sometimes heals and sometimes becomes latent. In *sannipatic* upadangsa, all the above symptoms appear together, the parts crack, maggots generate, and death ensues."

From this description of upadangsa it would appear that Susruta does not mention that the disease is contagious, that there is occurrence of bubo or constitutional symptoms, or that it attacks women. Simple inflammation or ulceration of the penis, arising from mechanical injury or impurity, is described as upadangsa. If we turn to the chapter of Susruta's treatment of syphilis, we find that he treats of it as a local disease. He does not talk of mercury as a medicine for upadangsa. From this we may safely conclude that syphilis, if it at all existed during Susruta's time, was not our modern constitutional syphilis, but only that local variety of this disease which is called soft chancre. So far Charaka and Susrutas on syphilis.

Now, turning our attention to "Bhava Praksh," another Ayur Vedic treatise compiled by Bhava Misra, a Brahmin Pundit, we find a description of a new disease which is analogous to our modern constitutional syphilis. This disease Bhava Misra calls *ferunga,* or disease of the Feringees. He says :—

"(*a*) This disease prevails abundantly in the country called *Ferunga,* and hence it is called 'ferunga' by those who study disease.

"(*b*) This disease arises from touching the body of the Feringees and from sexual intercourse with Feringinees (Female Feringee).

"(*c*) Ferunga is of three varieties—external, internal, and both internal and external. Of these, external ferunga manifests itself as a small abscess or boil ; it ulcerates and heals easily. Internal ferunga attacks the joints, there are rheumatic pains and swelling of the limbs.

"(*d*) Emaciation, weakness, nasal disease, loss of appetite, atrophy and deformity of bones are the complications of ferunga.

"(*e*) External ferunga of short duration and uncomplicated heals easily. Internal ferunga heals after a long time, and the third kind of uncomplicated also heals readily ; but if it has complications, and is of long duration, it does not heal."

Then, turning to the chapter of *Treatment,* we find that Bhava Misra advocates the use of mercury as the only curable agent in case of this disease. To be brief I will not quote the *slokas.* But Bhava Misra asserts that *rassa kappur* is the best medicine for this desease. Rassa kappur is a form of mercurial preparation. He also talks of mercurial fumigation as one of the means to exterminate this disease.

The symptoms and treatment described above points conclusively to the fact that modern syphilis and ferunga are different names for the same disease.

"Bhava Praksh" is an Ayur Vedic compilation of more modern times. Though we cannot tell its exact date, yet it is affirmed by many that its author, Bhava Misra, flourished during the Mahomedan period. In popular language, the Portuguese descendants in India are called Feringees, and it is not improbable that feringee and ferunga are the same. The Portuguese settled at Goa during the commencement of the sixteenth century, say, about 1502 or after. So we may safely conclude that syphilis was imported into India about this time with the Portuguese settlers. European authors assert that syphilis became epidemic in whole Europe in the year 1495. This was shortly after the discovery of America by Columbus, which event took place in 1493. It is said that the troops of Columbus were attacked with syphilis while they were in America. So it is probable that syphilis was introduced into Europe from America, and from Europe it was brought into India by the Portuguese settlers.

DISCUSSION.

Dr. Carleton said that he was strongly of the opinion that syphilis had been introduced into India in comparatively recent times, or since European contact with the country. In the Punjab, syphilis was very prevalent in certain portions of the hills, as in parts of Kangra, about Simla, the Kulu Sub-division, and the small native states generally. The people say that the disease was not known thirty years ago. First, Ranjit Singh's soldiers brought the disease into Kangra; later, Kangra soldiers, sent to the tehsils and thanas, took the disease into the western parts of Kulu. In the eastern portions of Kulu, he had carefully examined certain syphilitic districts, and had found the disease was introduced from Simla by a single person and that within about twenty years.

About Simla, within a radius of twenty miles, not more than two or three per cent. of the population had escaped the disease.

Along the lines of communication and in the large cities syphilis was very prevalent, but in villages, thirty miles away, hardly a case was found.

In the Punjab the most common name for syphilis was "bad farung," or "disease of the foreigners." Considering these points, he was strongly inclined to think that syphilis was not endemic, but had been introduced into India in comparatively recent times.

GLEANINGS FROM THE EARLY RECORDS OF THE BENGAL MEDICAL DEPARTMENT.

BY T. H. HENDLEY, C.I.E.,
Brig.-Surgeon Lieut.-Colonel, I. M. S.

THE early history of a great State department must always be of interest to its members. I have, therefore, thought that a few notes from the records in the office of the Surgeon-General with the Government of India, which I was allowed to examine some time ago by the kindness of Dr. Rice, the present head of the Indian Medical Service, might not be unworthy of the attention of the Congress.

These records open with an account of the establishment of a Military Board "for the purpose of directing the necessary regulations and arrangements" for all the hospitals at the Presidency. The Honorable the Governor-General (John Macpherson, Esq.) and the Council nominated Mr. James Ellis, Physician General, as Director of the Hospitals. Mr. Andrew Williams, Chief Surgeon, and Mr. John Fleming, Surgeon at the hospital established at Head-quarters, to be members of the Board. Mr. Birch was also appointed Purveyor and Mr. Edmond Bengough, Apothecary. The first meeting of the Board was held on May 29th, 1786, only sixteen months after Warren Hastings left India, at the house of Mr. Ellis. On June 3rd, in accordance with the request of the Board, the Governor-General and the Supreme Council appointed Mr. Thomas Gillies to act as Secretary.

The following are extracts from the regulations respecting Military Hospitals in India which were read to the Board on June 6th, 1786, or more than 108 years ago:—

"Having thought fit to reform the Medical Departments in India, and to place our military hospitals on a regular system, by which their annual expenses may be reduced and accurately ascertained, the sick and wounded properly attended to, and the gross abuses checked of receiving into the hospitals men with trivial complaints, to the great loss and prejudice of the public service, the following rules and orders are henceforth to be established at the different presidencies:—

"1. With a view to give every degree of encouragement to men of professional abilities and integrity to prosecute the medical line in our service in India, we hereby direct that at Bengal and Madras there shall be a Physician General as Director of the Hospitals with a salary of £2,500 per annum and the head surgeon of every hospital, where 8,000 men may be stationed in peace or war, shall have a salary of £1,500 per annum, and the head surgeons of all the other general hospitals are to receive each £1,000 per annum. All surgeons to regiments shall have the pay and emoluments of a captain of infantry upon our establishment; hospital mates, the pay and emoluments of lieutenant of infantry upon our establishment; and regimental mates the pay, etc., of ensigns of infantry upon our establishment.

"At Bombay the Physician General, as Director, is to receive a salary of £1,500 per annum, and one hospital surgeon with a salary of £800 per annum. The surgeon to regiments are to receive the pay and emoluments of captain, etc., as before.

"2. The second head relates to the establishment of the Board; the third is as follows:—

"3. The members of the Hospital Board shall recommend to the Governor-General and Council the most able and deserving officers to direct and superintend the duties of each hospital, and they are to be responsible for the conduct of those who may be appointed in consequence of their recommendations. When a vacancy of surgeon at the head of any of the hospitals shall take place, the Hospital Board will recommend to the Government and Council the most deserving regimental surgeon for the succession, the most deserving hospital mate to succeed the regimental surgeon, and the most deserving regimental mate to succeed the hospital mate. But although the most simple encouragement is hereby given to merit, yet it must also be understood that seniority and equal merits are to have the first claims to promotion.

"4. As the head surgeons are to be responsible for the officers under their command, they are to have the power of suspending such inferior officers who may disobey their orders, or prove negligent or inattentive, and further to report the same to the Board for the information of the Governor-General and Council.

"5. The head surgeon is to assign the several parts of duty to the inferior officers, to direct that the sick shall be conveniently lodged in wholesome wards, having a free circulation of air, that they be kept clean and not crowded in their apartments, and are regularly subsisted agreeably to the diet tables established for that purpose. He is also empowered to dismiss nurses and servants for neglect and ill-qualifications.

"6. He is also responsible that the sick soldiers have clean cots and clothing, and that no one takes rewards from them.

"7. The seventh head refers to admission of sick only on proper order from their commanding officer, with certificate from the surgeon's mate of their regiment setting forth their diseases, also to records, day books, etc.

"8. Medicines are to be supplied only on the order of the surgeon, and an account of issues is to be kept in a journal.

"9. Weekly returns of sick are to be sent by surgeons of regiments to the head surgeons of the general hospital of districts.

"10. Monthly returns are to be sent by the latter with requisitions for medicines to the Board.

"11. The oldest hospital mate at each general hospital is to have charge of the medicines, but only to issue them on the authority of the head surgeon.

"12. Para. 12 refers to the appointment and duties of purveyor of all stores, except medicines.

"13. Contracts for provisions are to be approved by the Board, and not to be above market rates.

"14. Para. 14 refers to appointment of an apothecary to look after the medicines and to boards of survey of damaged drugs. Invoices are ordered to be submitted every quarter.

"15. The hospital guard is to be supplied from the nearest regiment, and to be regularly visited by the officer of the day. The head surgeon, or the first mate, is to accompany him on his rounds, and answer such queries as tend to afford satisfaction regarding the situation and treatment of the sick.

16 & 17. Para. 16 relates to inspection of regimental hospitals by head surgeons, and para. 17 states that the officer, who is commander-in-chief, should maintain good order and discipline." It will be seen from these regulations how careful the Company was to obtain good medical officers and to encourage them by holding out fair prospects of promotion. It has been said that in after-years more regard was paid to seniority than to merit in considering claims for advancement, but this defect seems to have been common to the general system, and not to have been confined to the medical department. The estimation of salaries in pounds sterling may suggest to the present generation of medical officers that they are less fortunate.

Payments, however, where made in sonat rupees at the following rates :—

The Physician General received Rs. 1,666-10-8 per mensem, his pay being £2,500 per annum, without quarters.

A chief surgeon drew Rs. 1,335-5-4 per mensem, the equivalent of £2,000 per annum, and the head surgeon at head-quarters, or where there was a garrison of 8,000 men, Rs. 1,000, or at the rate of £1,500 per annum. The head surgeons of other general hospitals were paid Rs. 666-10-8 or at the rate of £1,000, exclusive of the pay and batta of a captain : 400 sonat rupees were worth 18 rupees less than 400 sicca rupees. The purveyors and other accounts were kept on the former currency. Eight sonat rupees were thus held to be equal to one pound sterling, and the Court of Directors afterwards ordered that the rate of exchange for the civil line should be fixed at 8 sicca rupees and for the military line at 8 sonat rupees.

The Company, as was fitting, was very strong on the questions of discipline and of control of the chief surgeons over the subordinate officers and establishments.

Great stress was laid, as will be again noted later on, upon the cleanliness of the wards, upon their not being overcrowded, and on the free circulation of air through them. These views are the more remarkable, because it is well known that the barracks, military hospitals, and even civil hospitals in Europe were very much overcrowded, and in a most unsanitary condition a hundred years ago.

There was a great desire to care for the soldier and to see that he was not robbed : he was to be seen every day by the officer of the guard, as well as the surgeon, and to be carefully fed. Every European regiment of cavalry was to have one surgeon and two mates, while a battery of artillery or a regiment of infantry had to be content with a surgeon and one mate.

In regiments of both arms of Native troops, there was one surgeon assistant and a black (*kala*) doctor.

The peace establishment of the armies of the three Presidencies was as follows :—

Bengal	...	7 surgeons,	45 assistants.
Madras	...	6 surgeons,	52 mates.
Bombay	...	3 surgeons,	14 assistants.

In one of their letters the Court of Directors refer to the good policy and humanity of proper care of the sick and wounded, and express the intention of abolishing the absurd practice of allowing surgeons to benefit in proportion to the number of sick and duration of their stay in hospital. I believe it took many years to completely put a stop to this reprehensible practice. It was again observed that the regulations were also intended to hold out encouragement to men of abilities and character to prosecute the medical line in India by establishing reasonable progression of rank from the highest to the lowest stations in the Company's service.

Notice was taken of the employment of too many assistants, and instructions were issued that any in excess must depend on private practice, or in certain cases be paid subsistence money until regular vacancies should occur. It appears that in most cases men were appointed in Europe, but others were entertained in India. It was a common practice for the Directors of the Company to confer permission on surgeons to proceed to Bengal to practise the medical profession, and in due time many of these were taken into the services when vacancies occurred.

Disputes as to rank and standing in the service thus not unfrequently arose between assistant surgeons who were appointed at home and those who were entertained in India.

Mr. Bainbridge contends that his indenture directs him to go "to Fort St. George, or any of the Company's settlements where his services may be wanted," hence when he reached Madras his friends advised him to come on to Bengal where he was assured there was the greatest want of assistant surgeons, but the Board resolved that he was to rank as an assistant surgeon appointed in the country below those sent from home.

Instructions for the purveyor were drawn up on June 9th, 1786. The following is an extract regarding drink for the sick Europeans :—

"The common drinks in full and middle diet are to be water, toast and water, or barley water, with one spoonful of good Batavia arrack to each pint of wine and water, with two ounces of Madeira wine to a pint of water. For a low or milk diet, barley water, with or without wine—Madeira or red."

Wine was a very expensive item in the cost of treatment of the sick. The Garrison Surgeon at Fort William in 1786 estimated the expenditure at about two glasses per man per diem, which for four months at 20 per dozen equalled Rs. 900. Under regulations published in 1787, only Madeira was to be used, not in excess of six dozen per mensem for twenty men, one dozen to cost at Berhampur Rs. 13, at Dinapur Rs. 14, at Chunar Rs. 16, at Cawnpur Rs. 18, and at Futtyghur Rs. 20, and no spirits were to be given internally.

We thus get some idea of the cost of carriage up-country a hundred years ago. In 1786 the Physician General complained that in the Calcutta hospitals the men had access to spirituous liquor whenever they liked. Head Surgeon Hunter, of Berhampur, states that the soldiery in this country have ever been observed addicted to liquor and free use of it, yet notwithstanding the orders of Government te restrain and keep them from intemperance, the efforts of their commanding officers are ineffectual ; at this station the vicinity of the foreign settlements is favourable for the purchase of spirituous liquors of all sorts, while it also affords ample field for indulgence in promiscuous intercourse that is productive of many evils. In Berhampur in April there were 163 venereal cases in hospital and in May 172. The two great curses of armies were, therefore, felt severely enough by our predecessors.

Attention was paid to cleanliness of the hospital wards. It was ordered that they should be cleaned twice a day, and fumigated once or twice a week with Benjamin.

Mr. Fleming, the Head Surgeon of the Calcutta General Hospital, however, wrote that his hospital was one of the most destructive places to which the sick could be sent.

He remarked "that it is universally allowed that sobriety, fresh air and *cleanliness* are of as much or perhaps more consequences in the prevention and cure of diseases than either doctors or medicines, and it is evident that whatever care the surgeon may take to provide his patients with wholesome food and the strictest medical attendance, his endeavours must be fruitless, if the hospital be so ill-secured that the soldiers can have access to spirituous liquors whenever they think proper, if the wards be so ill-constructed as to render it impossible to keep them dry and clean, and if the men be under the necessity of constantly breathing an atmosphere contaminated by the stink of necessaries fitted up under the same roof and on the same floor on which they sleep. This, however," he adds, "is an exact description of the Calcutta Hospital."

It will be observed that very enlightened opinion was available, but custom and prejudice long stood in the way of great improvement in the matter to which Mr. Fleming referred.

Action was taken immediately by the Government on the question of fumigation. The Secretary to the Military Board asked for opinion as to its utility.

The Medical Board did not think that, as a rule, in dry, well-ventilated and not overcrowded barracks, fumigation was necessary. They were of opinion that "where cleanliness is neglected other preservations will avail very little ; where it is observed they will in general not be necessary. Where there are many sores, damp atmosphere, etc., fumigation is useful. Resinous woods, resins and vinegars of the resins dropped on hot iron are best, also a red-hot ironbar stirred round in a bucket of common tar and moved about the ward once or twice a day, also hot vinegar thrown about by a syringe with a rose. This will not do for chunam (lime) floors. Lime water and lime washing are beneficial in absorbing the fixed air which is generated in the bodies of men and animals." Perhaps we have here the origin of the great faith in white-washing which still exists in India.

It was decided that the arrangements proposed for the medical attendance in the Army did not interfere with the provision for the Civil Servants at the Presidency, or in subordinate stations or factories, but that surgeons then serving in the civil line might join the Army at once or at six months' notice on the occurrence of a vacancy, but only one surgeon, and he after ten months in which to settle his affairs, elected to do so. Thus at a very early date the civil division became the most popular branch of the service.

In November 1786, Colonel Ross, the Military Secretary, writes to the Board that the Governor-General, Lord Cornwallis, "having reason to believe that there are medical gentlemen placed at many collectorships or residencies where few Europeans reside, desires that you will, after obtaining proper information and due consideration of this subject, report the names of the collectorships and residencies belonging to this Government, where, in your opinion, the Civil Servants are, from their number or peculiar situation, reasonably entitled to expect the appointment of a medical gentleman to reside constantly with them." Lists were also called for from the Adjutant-General and from the Secretaries to the Revenue Department and the Board of Trade.

The list from the last-named, also known as the Commercial Department, shows that surgeons were stationed at Cossimbazar, Bauleah, Commercolly, Patna, Dacca, Luckipur, Islamabad and Midnapur.

The records of such of these places as are still occupied would, no doubt, afford interesting reading. The allowances in the Revenue line were for a full Surgeon Rs. 300, and house-rent Rs. 100 in sicca coinage. For an assistant surgeon Rs. 200 with Rs. 100 house-rent, but the cost of medicines was not included. It appears from a letter addressed in 1788 by Mr. Warams, Surgeon at Fort Marlboro', which was then under the Chief and Council of Bencoolen, that he considered his salary very small, because surgeons in the Civil line had a share in trade, especially in one place which was valued at £1,500 per annum, and of course there was the chance of private practice.

The following very important order was issued by Earl Cornwallis on November 11th, 1788: "Minutes of Council in the Secret and Separate Department, dated 24th October 1788. The following rules and orders have been passed for the Medical Department of the service and are to be considered as taking place from the first of the month:—

"Article 1.—Resolved and ordered that all medical gentlemen employed in the Company's service under this Presidency be continued in one general list; that they have commissions granted to them agreeably to their proper ranks as army surgeons; and that, whenever employed in the civil line, they be considered for a time as lent only to that department of the service and liable always to be recalled to their duty as military surgeons under the restrictions and obligations of service which are annexed to their military commissions." By Article 4, the title of Physician General was changed to President of the Hospital Board, and the other two members were the Chief Surgeon and Head Surgeon of the General Hospital at the Presidency.

"7.—It was resolved that, in consideration of the importance of a proper discharge of the duties annexed to the station of a member of the Hospital Board and of the experience requisite for the charge of a general hospital, that these situations be always filled up by selection from the most capable practitioners without any other regard to seniority on the list of full surgeons, than may be derived from equal skill and abilities in either profession.

"11.—Full surgeons who preferred remaining at subordinate stations, or who declined (if called upon) to join an European battalion, forfeited claim to a succession to the Medical Board, or the charge of a general hospital.

"12.—All assistant surgeons promoted to full surgeons should give up their claim to future preferment or quit their station and assume the duties of the rank to which they were promoted, or of the station to which they were appointed, either in the civil or military line.

"15.—Every assistant surgeon was first to bestow all his time and attention to the practice of the general hospital. It was thus clearly laid down that the Indian Medical Service was a military one, but at the same time the civil line afforded the best training possible, and allowed of the employment of a large number of supernumeraries at little or no expense, who were always available for service in great emergencies, such as did frequently occur in the early history of British rule in India, and which may recur at any moment. Great emphasis was also laid upon the necessity of appointing as members of the Board only the most capable practitioners without regard to seniority."

Assistant surgeons were allowed to decline promotion, but lost their claim to future preferment.

It was sometimes a very serious thing when a man was compelled to move to another station, as appears from the case of Mr. J. Williams, of Juanpur, who was ordered to proceed to Dinapur. He begged that he might be allowed twelve months to settle his private affairs, "as owing to his situation in the service for some years past having scarcely afforded him subsistence, he had been induced, with a view to providing for his family, to enter into some concerns of a private nature, to leave which together with the bungalows and other conveniences, with which he had furnished himself at considerable expense, would be attended with a very heavy loss at that time." He was allowed to remain, but without allowances, so that after all even the strictest rules are found to have exceptions. After the issue of the letter above referred to, it was ordered that all warrants should be returned for the issue of military commissions. It was also laid down that in order to succeed to the Medical Board, two years must be served at the Presidency, or as surgeon to an European battalion. There were twenty-eight full surgeons, and the following principal appointments were always to be held by one of them, five at the Presidency and one each at Lucknow, Benares, Patna, Murshidabad, with Cossimbazar and Dacca.

The surgeons at Tirhoot, Luckipur, Commercolly, Cossimbazar, and Shahabad declined promotion, and three officers at Chittagong, Midnapur, and Behar accepted. Medical officers were by no means backward in their endeavours to advance their profession, for example, Dr. Balfour refers to an improvement in medical practice which he describes as a successful and certain method of curing the destructive remittent fever of Bengal by giving the bark in the fit, as well as in the remission of the fever.

In 1788 Mr. Wade, of Chunar, submitted proposals for a medical library, but the Board disapproved, but there were such libraries at other stations. A long treatise on fevers was sent to the Board for its opinion. In it wine and bleeding were much objected to. Antimony was thought to be useful, as it produced vomiting, but the special object of the communication was to prove the value of the treatment by active purges, and especially by the administration of five, ten, or sixteen grain doses of calomel.

Drugs were very expensive. For example, when the supply of Glauber's salts in the stores was exhausted, none could be expected for six months, the apothecary was allowed to purchase eighteen hundredweights in the market at a cost of Rs. 1,945. This quantity could not be bought by any one for Rs. 180 in Calcutta. The retail price was one rupee. It is now, in our inferior currency, only four annas. Ipecacuanha was sold at twelve annas per pound. Cream of tartar at thirteen and rhubarb at three, the present wholesale prices being 9, ¼ and ¼ respectively. It was, of course, the bulk of the Glauber's salt and consequent expense of carriage, which was the principal item in the expenditure, though the improved methods of manufacturing soda salts have a great share in the present low rate of the drug which is only worth £5-10-0 per ton in England. Medicines were given from the Company's stores to the inhabitants of Calcutta, who were not in the Company's service at twenty-four per cent. profit.

The Company lost no opportunity of recommending what were thought to be valuable improvements, for example, a number of bottles of Ruspini's stypic were sent out for trial in 1785 ; and fifty tracts, two drags and apparatus for recovering persons apparently drowned were received from the Royal Humane Society and forwarded to be used and the patterns copied.

The Commander-in-Chief authorized the inoculation of the men belonging to the Corps of Artillery and Infantry in Garrison at Dum-Dum, who had not had the small-pox. A bungalow was, therefore, ordered to be built for the men who were not put under stoppages, as was the case with the sick in general. Submission to the operation was quite voluntary.

The first proper provision for the insane was made in May 1787, after the death of Mr. Kenderdine, who had a house for such persons, but no suitable arrangement for them. Assistant Surgeon Dick, who was in charge of the insane house, bought sixteen battalion cots for the insanes at Rs. 6 each, but they broke them to pieces in the first month, whereupon he purchased twenty-four at Rs. 16 each, "so strong that the most furious of them cannot break them in the least, they would last for twenty years." They were made of teak and had boarded bottoms with head, foot and side-boards, all well secured with iron clamps. He also provided a number of straight jackets and iron chains for the legs, with jointed hoops to go round the waist, and shackles to confine the hands, at Rs. 3 each set.

A list is given of officers and privates who were in the house in February 1788. Their pay went towards their keep. Rs. 50 per mensem were charged for other persons, and for this sum they were allowed tea, bread, butter, and wine twice a day.

Sanction was given for one cooly to attend each insane person, besides Rs. 10 for each sergeant or private attendant, of whom there were to be four.

The Governor-General supposed that the relations of insane gentlemen, who were not in the service, would support them, but added, "if not, the public will."

Mr. Dick proposed that there should be a separate house for insane women, as two had been sent to him, and both were furious. He stated in sending in his estimate that he could not get near fifteen per cent. for his money. The Board thought Mr. Dick's offer of a house at Rs. 200 a month for the women was reasonable.

At the period to which these early records relate, it was the rule that when medical officers went to England, they had to resign the service of the Company, but they usually took with them a letter recommending them for reappointment and reinstatement without prejudice to their service. Thus, for example, Mr. Williams, Chief Surgeon, asked for leave for three years on half pay or on full pay in India, but he was informed that he must resign and be recommended for readmission should he return. He complained that Mr. Ellis, the Physician General, had been promoted over his head, though he had been nine years at home without doing anything for the Company. Mr. Gillies asked for three years leave, as his health had broken down after 16 years' service in Bengal. It is not wonderful that men took long leave, for we read that Mr. Burt, who was appointed assistant surgeon in 1787, was a year on the voyage, as the India men had to wait for convoys, because the British nation was then contending with enemies in every part of the globe. The peril of voyage was indeed great, as appears from a letter of Mr. Stormouth, Head Surgeon at Dinapur, who asked that in case of his being shipwrecked this side of the Cape of Good Hope, he might not be considered out of the service. There are a few notices regarding the value of house property, as well as the salaries of clerks and wages of workpeople.

Lieutenant Berkeley, of Chunar, offered his house as a hospital. It had cost him Rs. 3,000, and was all pucca, except the roof. It consisted of two rooms, each 18 feet by 14, and two 14 feet square, each with a front verandah 60 feet by 18, and a back one 22 feet by 14, as well as all necessary offices, a garden with fruit trees and three bighas of land. His offer was not accepted, but an estimate was made of Rs. 5,637 for providing a new building.

The establishment of the Medical Board received pay as follows : Copier of the proceedings, Rs. 100 per mensem ; copier of letters, orders, etc., Rs. 100 ; his assistant, Rs. 30 ; examiner of accounts, Rs. 50 ; duftry, Rs. 8 ; two peons at Rs. 5 each. The house rent was Rs. 318-12.

The office establishment, according to the orders of Government, attended for six hours daily, either in the morning or evening, as the heads of the offices might think proper, but not later than 9 P.M. The Hindu writers were afterwards only allowed Rs. 50, and the rent was reduced to Rs. 250.

Domestic servants were paid at the following rates: Bhisties Rs. 5, dhobis Rs. 5 and 6, sweepers Rs. 4, head sweepers Rs. 5, peons Rs. 4. A bhistee and sweepers were allowed to every two officers of lieutenant's rank and were part of his privileges. One bhistee and one sweeper were allowed to the surgeon.

All medical charges, except doolies, were to be borne by the surgeons of sepoy battalions, but by a minute of Council it was afterwards orderd that 12 sonat rupees per company of lascars should he paid to surgeons for all medical charges, except doolies.

Mr. Bingham, in writing his case, states that in 1784, after commencement of the Canicular months, he was afflicted with a slow nervous fever. In 1787 Mr. Fontana was especially appointed to see the sick in jail under the head surgeon, instead of the mates who used to visit it in turn. The Secretary to Government forwarded twelve copies of a memoir, explaining the general utility, as well as the proper mode of obtaining a precise knowledge of what may relate to serpents or snakes, which were distributed amongst a number of surgeons for opinions and collections, if they had any, or observations on that class of animals.

A letter from Dr. Francis Balfour to the Hon'ble John Macpherson. Esq., Governor-General, and to the Members of the Supreme Council, is worthy of being given almost in full: —

"HON'BLE SIR AND SIRS,—The remonstrance of Mr. Monro, Mr. Ferguson and Mr. Boyd, against my rank, to which I am desired by your Honourable Board to reply, seems to contain four objections or arrangements which I shall consider separately. However, I cannot help expressing my surprise that a remonstrance addressed in July 1784 to the Hon'ble Warren Hastings, Esq., should be for the first time transmitted to me for a reply in August 1786, when Mr. Hastings is no longer Governor-General and Mr. Ferguson, one of the gentleman who signs the remonstrance, has been more than a twelve month dead. . . . . When I arrived in Bengal and until within these few years I have already observed that it was customary in the service for an assistant surgeon to hold likewise a subaltern's commission in the Army, and he was allowed to retain both until he arrived at the rank of either a full surgeon, or of a captain, at which time he was obliged to relinquish his other appointment and to attach himself to that line only in which he had received his promotion. Mr. Cranstown enjoyed both for several years, and held them at the time of his death, and, if I am not mistaken, Captain Frederick Breton held both until he was promoted to the rank of captain, at which time he lost his appointment of assistant surgeon.

There are other examples which I don't recollect exactly. I held both appointments until I returned from Madras in 1778. I was then promoted, and became a full surgeon, and dropt, of course, my commission in the army. On a former occasion I took the liberty of laying before yonr Honourable Board certificates of three different commissions from the Company, the originals of which are in my possession. By the first I was appointed an assistant surgeon in November 1768 by the Honourable Court of Directors, by the second my rank on this establishment was fixed and confirmed in July 1769 by the Hon'ble Harry Verelst, Esq., and Council, and by the third I was promoted to the rank of full surgeon in August 1777 by the Supreme Council." Mr. Hay, the Secretary to the Government, wrote to the Board that it appeared on a reference to a return of the 2nd Brigade, dated December 1785, that Lieutenant Francis Balfour stood on the strength of the brigade as a lieutenant and not as a surgeon. By a general order of 15th December 1769, Mr. F. Balfour was appointed an ensign by the Governor-General, and later on advanced to the rank of lieutenant, and as such in 1776, by a minute of Council, he was permitted to remain twelve months with the Nawab of Arcot. In 1778 he was permitted to retain his proper rank in the list of surgeons, according to his original warrant of assistant surgeon, which was dated at Fort William on the 2nd July 1769, and a warrant as full surgeon was granted him from 16th August 1777. The name of Lieutenant Francis Balfour was then ordered to be struck off the list of the Army. In 1786 he became surgeon in charge of the Chunar Hospital, which had first been established, and afterwards obtained a seat on the Medical Board. A letter from Lieutenant Stanton to Mr. Hamilton, Senior Surgeon at Futtyghur, shows that a general order was issued, by which gentlemen, serving in both the military and medical lines, were desired to relinquish one or the other of them, on this account he offered himself as a regimental mate to the 8th Battalion of Sepoys to which he belonged, because he had been bred a surgeon.

I quote this to show that a double commission was usually held with the opinion of relinquishing one profession or the other; but it also indicates that medical men occasionally entered the service as combatant officers, possibly because after spending some time at the Presidency, they had no prospect of obtaining employment in their own profession, or were unable to live by private practice.

Mr. Anderson, of Chunar, stated that he was an ensign in the 1st Regiment of Europeans in June 1781, but the Commander-in-Chief, finding that he had been a regular bred surgeon, and had practised for twelve years, ordered him to act as assistant surgeon, and that he some time later asked permission to resign, in order to rank in the physical line. With these notes regarding rank and the medical service and its dual nature, I conclude my extracts from the records, in the hope that some one may be encouraged to pursue the subject, and write a full history of the Indian Medical Service, as I am sure it could not fail to be of much value and interest.

SECTION
OF
OBSTETRICS.

PRESIDENTIAL ADDRESS.

BY H. PEERS DIMMOCK,
Surgeon-Major, I. M. S.

It is my especial privilege on this auspicious occasion of the first Medical Congress in India to open the proceedings of the section in obstetrics and the allied subjects of gynæcology and pædiatrics, and it is a privilege which I feel to be one of great distinction and honour to that degree that I have had some difficulty in the selection of a train of ideas suited to such a wide-reaching object as our meeting to-day must be—wide-reaching, not alone in the sphere of Indian Medical Science, but also in the consideration of the Argus-eyed public that now watches with ever-increasing interest proceedings and intentions that bear upon the physical weal and hygienic progress of the people of this Eastern Empire. It is a matter for congratulation and joy that not only the men of India have awakened to the enormous benefit to humanity that skill in these particular branches of medical science will convey through the alleviation of pain and suffering and the insurance of a higher standard of future maturity, but that also the women of India are speedily recognizing and adopting the benefits that accrue to them thereby in their hours of difficult travail, in the rearing and healthy management of their children, and in the treatment of the particular ills to which they are so often the unfortunate heiresses.

This happy consummation of philanthropic hopes, this cutting of the Gordian knot of the conservatism of custom, has been furthered by the humane sympathy and loving benevolence of the Countess of Dufferin, whose name will be handed down to posterity, particularly in India, as a benefactress of womankind, while her scheme for help thus inaugurated has been and will be still more promoted by the intelligent appreciation and assistance with which the more enlightened men of India have sought and encouraged the bringing of skilled aid to their wives and children into the secluded precincts of the zenana. This ready adoption of means for the relief of such suffering within so short a space of time promises great impetus to the advance of knowledge in the subjects of this section, of which India stands so much in need, and which has from centuries immemorial languished in the most deplorable depths of ignorance and superstition under the peculiar prohibitive customs of the people of the land, and the unclean and repulsive traditionary methods of the native midwives.

As this new light is spread amongst the people by the medical men and women pioneers of our art, we may look forward to a fulfilment of the results of higher knowledge and skill, as well as to an appreciation of those efforts that cannot only relieve the acutest suffering, but can so often crown the hopes of a happy family.

In our particular corner of the world's work, it is our beholden duty—and I am sure it is with most of us our enthusiastic pleasure—to strain our intellects to add to the knowledge that will help on, enlighten, and inspire our fellow-workers; and we should remember that even a little good work done and recorded often goes to the piecing together of a great discovery. The geniuses of every generation who have been led to the exposition of some great truth have mostly gained intuition, aid, and inspiration from the labours of others, past and present, and have based on them their observations and conclusions.

It has been their particular gift to unite these fragments into the whole, and to gather together the facts of knowledge thus previously worked out, often in an apparently insignificant degree, further adding the requirements that constitute the full evolution of the master mind, and placing them together in the progressive steps of entire and true completion.

So let us ever be certain that as we glean the stray cornstalks in the field of experience, it is in our hands to furnish material for the skilled labourer to bind into goodly sheaves. In searching for a fit subject for this address, it seemed to me better to select matter of some unique interest than to generalize in the many attractive ideas that such a meeting as this would be sure to call up. Indeed, these particular branches of medical art have not progressed in India in anything like the way that general medicine and surgery have done, owing to circumstances to which I have already referred, as well as to the unwillingness of Indian women to enter hospitals, to undergo operations, and to submit themselves or their children to treatment at the hands of male practitioners, and to have given a review of the advances made in these subjects in India would have been a somewhat barren task. One can point to the works of Tilt, Birch, Joubert, and a few scattered records in the various ephemeral Indian Medical Journals that have brightened the dim history of the labours of the last fifty years, but there has been no attempt to systematize or to establish a permanent literary interest in these branches, such as is the case in the countries of Europe. The second generation of Indian medical practitioners has reached maturity, and still these important subjects are in their infancy with us. There are many parts of them in which we require full and accurate information of special application in India.

In obstetrics it is self-evident to anyone with a modicum of experience that, on account of the great variance in the measurements of the pelvis and the development of the child in the different races, the whole gamut of operative manipulations must differ greatly, and such a consideration alone would demand an entire text-book of careful collaborative experience.

A wider knowledge of diseases occurring particularly in women in various parts of the country, with methods of treatment and the results of operation, is much to be desired.

The diseases of Indian children are comparatively an unopened subject, and promise a novel, instructive and extensive sphere of most useful enquiry to those who have the opportunities and advantages, and will take the trouble to record experience in them.

It is time that we awoke from our lethargy. May our meeting of to-day be a trumpet-call to workers throughout India for further re-advance all along the line of these particular subjects, and perhaps a suggestion for the foundation of an Indian obstetrical society, similar to the London one, may not fall amiss in this enlightened city where the torch of progress has been uplifted to light the way of encouragement to a mutual interchange of thought and ideas.

Posterity demands it as a duty, and women doctors, especially with their many advantages, must not forget that it is our obligation to add to accurate knowledge, as well as to relieve suffering.

Now, as my mind has for a time been much occupied with some stiff problems in puerperal fever, I decided with diffidence to attempt to record the still imperfect, but extremely interesting, solutions that certain such cases have presented to me.

Since Professor Semmelweiss first placed us in possession of the axioms of puerperal fever, there has been accumulated a mass of evidence to demonstrate their truths, and fresh knowledge has been added to them, especially by the discovery of the antiseptic system of Lister.

But though the ideas of all authorities are fairly well defined, there are still many effects and conditions of puerperal fever and points of difference that are hard to reconcile. This is especially the case in a country like India, which teems with forms of pyrexial diseases that are liable to complicate the pregnant and puerperal states. To indicate all forms of puerperal fever, as puerperal septicæmia, whatever the infective cause, and however much the symptoms may vary, is alone sufficiently confusing, when we are brought face to face with their actual protean clinical facts ; and on the other hand, to seek to differentiate each and every kind of puerperal fever according to its features, whether of cause or effect, would lead us into an interminable phraseology that would be too awkward for any practical purpose.

The old familiar term " puerperal fever " as a main distinctive indication is rendered sufficient for all purposes by the affix of a descriptive adjective for the special condition or cause associated with the pyrexia of the puerperium, which after all is the generic meaning of puerperal fever. Thus the words traumatic, septicæmic and pyæmic puerperal fever would describe fairly well the form of puerperal pyrexia that was associated with traumatism, septicæmia, or pyæmia. Any local effects can, at the same time, be described as complications, and we should thus have a designation like ' traumatic puerperal fever with pyo-metritis,' and so on.

To eliminate the special characters and peculiarities of these and other complex puerperal fevers, we require a very extensive knowledge of their clinical features, and in India we are confronted with so many kinds of the fever type of disease that such an enquiry is sure to be full of immensely interesting and intricate possibilities. Clinical observation and deductions thereform are always most attractive, and have been naturally the principal methods of elucidation of disease throughout all time of medical knowledge. They demand the first attention of the physician, and now-a-days, waited on by pathology and its youthful handmaid bacteriology, they are yielding most fruitful results. In these rapidly progressive days we are continually on the outlook for some fresh means of divining the actual causes and conditions of disease, and those occurring in the pregnant state, and the puerperium are so environed by their own peculiar accompaniments that there is a separate and special field for the study of them, both clinically and pathologically. In a research into the causes and effects of puerperal fever in India, we are confronted, not alone with special disease entities, but also with the many conditions peculiar to the country itself—of season and meteorological events, of race, of surroundings, of habits, of intercurrent disease, and of the preliminary effects of the pregnant state under such conditions, in all of which I can only suggest what a large field there is for philosophical, thoughtful, scientific and useful enquiry, especially to those members of the profession who actually practise amongst the people, and are intimate by race association with their modes of life and other influences.

In this there must be no quackery. " Quackery gives birth to nothing ; gives death to all things. We shall not see into the true heart of anything if we look merely at the quackeries of it ; as mere diseases, corruptions with which our and all men's sole duty is to have done with them, to sweep them out of our thoughts as out of our practice. Man everywhere is the born enemy of lies."

In a tropical climate the main influence would, of course, be that of the high temperature of the air, by which all developments and changes are brought about with a greater rapidity, so that the tissues become less stable, less hardy, and so tend to disintegrate quickly when once a rift is opened in their continuity.

The extreme changes of intense dry stimulating heat in the summer and of a depressing heat that comes with the onset of the monsoons, present aspects of variation, apart even from acclimatization, in the organisms of all who are subject to them, and still more of those whose temperaments are liable to an easy divarication of the physiological equilibrium, either towards depression or exaltation. In the pregnant woman we have to consider that there is a call upon vascular, secretory and excretory powers which react to such influences in accordance with the elastic requirements of each and every functional tension. Dry heat stimulates the circulation, raises the tension of the nervous system, excites greater metabolism, and, if the organism is in any way overbalanced, revenges itself for the disorder of its dominant systems by a furious hyperpyrexic confusion of its general processes. On the other hand, moist heat depresses the circulation, lowers the nervous tone, impairs secretion, and further promotes an accumulation of effete substances in the blood, either slowly or rapidly, so that morbid effects are easily engendered and with difficulty thrown off. So, too, meteorological changes exert their action in corresponding effects.

As examples of the differences of disease types under such circumstances may be taken the sharp attacks of fever which occur in the drier seasons of the year, and the low forms of continued fever and malarious cachexia with engorgement of the abdominal viscera, especially of the spleen, such as take place in humid states of the atmosphere and climates.

Frequently the slow development of malarious cachexia produces in the pregnant woman a form of pernicious malarious anæmia which is characterized towards the end by intense anæmia, œdema, and an enlarged spleen and liver, for the sluggish circulation and nervous debility encourage congestion of the organs.

Race may shew its influence in the various tendencies that are developed out of evolutionary characteristics ; as, for instance, the neurotic type rendering the woman more susceptible of nervous impressions and reactions, often altering the characters of disease by super-added nervous phenomena, such as high temperature quickly subsiding. Habits of food, of drink, and of luxury are worthy of reflective consideration, and it may be accepted as a fact that pregnant women, whose food is of a vegetable and unstimulating kind, will have less stamina in enduring prolonged pain and exhaustion, but will recover more quickly from ordinary trials than those whose food is of a more generous description ; while again the latter will be more liable to inflammatory reactions and rapid tissue changes, such as sloughing from traumatic injury.

The surroundings of pregnant and puerperal women are manifold in their effects, and include those of the room, the house, the village, and the town, septicæmic, zymotic, and malarious puerperal fevers being the most likely outcome of dangers from these sources.

I have had the usual experience of most enquirers in being baffled at the outset by forms of puerperal fever that I have had to deal with in India, and what impressed me most in the first instance with some of the cases was their unusual and surprising resistance to rigid antiseptic and aseptic precautions. A study of a series of temperature charts, and the effects of various treatment on the temperature, gave the true line of explanation. When once the clue was given, the opening of some of the hidden processes was shewn, so that I venture to tabulate certain forms of complex puerperal fever as follows :—

1. Malarious intermittent puerperal fevers :
    - (L) Quotidian.
    - (B) Tertian.
    - (Y) Quartan.
2. Malarious remittent puerperal fevers.
3. Thermic do. do.
4. Dysenteric do. do.
5. Syphilitic do. do.

I have no doubt that others will be added to their numbers as the science of medicine progresses, and wrest from the chaos of uncertanity the many forms of Indian fevers.

The protozoic causes of these fevers may develop in the pre-pregnant or the pregnant state, and be carried on into the puerperal state to be further impressed with a septicæmic pyrexial element, which is the result of the condition of the tissues and systems of the puerperal patient rendering the unusual secretions and excretions more liable to the action of infective agents. Or these causes may be latent in the system, manifesting no symptoms until they are excited to action by the onset of labour, or roused to a more powerful influence by a septicæmic pyrexia.

To deal with the group of the malarious forms of puerperal fever, I submit cases with their accompanying charts. Many of you may be familiar with an experience that pregnant patients in this country, who contract malarious fever, or whose systems are inoculated with its organisms, are very resistent to treatment for malarious fever or cachexia, either because the blood and tissues of the pregnant woman are very retentive or reproductive of the disease factors, or because they are specially vulnerable to and ineffective in repelling their ravages. How often it happens that a pregnant woman, suffering from malarious fever, is treated by all the known methods, which produce no yielding of the fever for some time, and when the pyrexia runs high, miscarriage is sooner or later brought about. The quinine may here be wrongly blamed for the mishap, which was in reality due to the everheated blood current and to the poisons circulating in it, and I have elsewhere protested against this shibboleth of the objection to use quinine in doses that are adequate for the control of the disease. At the same time we must not forget that sometimes malarious fever is not affected by quinine, and that the system may also be inoculated with previous treatment by that drug, so that it fails to give the expected result.

It may be some days even before an ordinary attack of ague in a pregnant woman can be controlled, and if the case is allowed to go on without treatment, the disease gets such a grip of the patient as to be uncontrollable, and if labour or miscarriage results an additional puerperal septicæmia is an inevitable result.

We are also all familiar with the sudden appearance of malarious fever coincident with a severe shock to the system, such as a fracture of a bone, the passage of a catheter, or an overwhelming emotion, and recollecting that the dilatation of the os uteri is often accompanied by a rigor, I have attributed the sudden accession of a high temperature at the commencement of labour to a disturbance of latent malarious poison by the vascular, nervous, and tissue changes wrought by the mechanical process of dilatation.

It is difficult to account in any other way for the sudden appearance of these fevers at such crises, when they have not been preceded by any signs of a taint lurking in the body, and I believe that the organisms are really latent, and that their sudden activity is because the balance of nervous control is disturbed by the event of labour, the vitality of the cells and leucocytes is diminished, and their ranks are thereby thrown open to the invaders, because the reflex irritation to the nervous centres causes through the trophic nerves changes in the metabolism of the body, and through the sympathetic nerves changes in the circulation which facilitate such morbid processes. It is the same with malarious fevers that develope after labour in association apparently with the stimulus to the plasmodia of slight or severe puerperal septicæmic pyrexia, and in these instances the puerperal fever will be established with the thread of malarious fever running through it and giving a distinctive character to the temperature record, for the treatment of which complex condition, it is necessary to combine methods applicable to both the diseases.

Further, whenever malarial fever is developed in the puerpera, there is a liability to what may be called an autogenetic form of septicæmia as a result of the high temperature of the malarial fever, for the lochial secretions decompose rapidly within the genital cavity, and their poisons are absorbed into the system, so as to produce the usual septicæmic effects in addition to those of the malaria, and thus to cause a continuance of pyrexia during the intervals that would be remissions of the malarial fever, and to exaggerate the high temperature of the pyrexial stage of the malarious attack. Very high and alarming temperatures are developed in this way.

Again, puerperal women who have malarial cachexia may have progressed favourably even beyond the first week, when they expose themselves to a chill, and this is followed by the typical phases of the rigor, of the pyrexic and sweating stages of ague. The lochia become offensive, the temperature is continuously high, and there is an intermittent recurrence of the ague and increased pyrexia. It takes several, sometimes many, days before recovery is brought about, while if proper measures are not adopted the case may end fatally.

In all these cases, associated with malaria of whatever kind, we have not only general effects to deal with, but also those local effects that are inevitably associated with the traumatism of labour. The lowered vitality of the tissues makes them very prone to take on a sloughing, or even gangrenous character, and such conditions are not only resistant to repair, and will heal slowly, but add a further and serious danger to the case from a multiplication of poisonous agents. If no treatment of the constitutional state is adopted, their ravages will increase to a terrible extent, so that I have seen cases of malarious cachexia in the puerpera where the genital passages have been in a gangrenous state throughout their whole area, consequently when artificial traumatism is produced by the use of instruments, particular precautions are necessary to guard against such effects, and although there may be no apparent symptoms, most rigid attention should be paid to the local antiseptic treatment Another effect of malarious cachexia and of malarious fever during pregnancy is to cause a placentitis from which the placenta becomes adherent, and so adds a further danger to the case at labour time. The shock of manual detachment may set up the pyrexia of malaria, or there may be infection from without by the operation. Such patients often complain of excessive tenderness over the uterus during pregnancy, which is, no doubt, due to the inflammation that is going on. Another effect of malaria in the puerperium is to produce intense neuralgia of some of the sexual organs. It may be the uterus that is thus effected, in which case it is probably caused by some inflammation of the nerve filaments communicated from a placentitis, or an actual primary neuritis of malarial origin, and the patient may suffer great pain, especially in connection with the after-pains. I have found the uterus in these patients to be excessively tender, and the condition has mostly yielded at once to quinine and anti-neuralgic drugs. I can recall one case of acute neuralgia of the ovary which followed a miscarriage. The patient did well in all respects, except that at a regular hour, every afternoon, she suffered from acute agonizing pain in the left ovarian region. It yielded at once to large doses of quinine.

Post-partum hæmorrhage is also very likely to occur, mostly from the effects of the placentitis, but also in consequence of the state of the blood, of heightened blood pressure, and of the defective contractile power of the uterine muscular tissue.

Diarrhœa is a frequent occurrence, and is of great importance. In all conditions of health or disease in people living in India, whether native or acclimatized, there is a primary climatic potentiality towards diarrhœa. A chill, an irritant, or disease are likely to be accompanied by it in ordinary individuals, and in puerperal fever particularly, this natural tendency is exaggerated by the secondary morbid and derivative tendency of the system to relieve itself of the toxæmia through the mucous membrane of the intestines. Accordingly the usual dose of castor-oil will frequently start a severe diarrhœa, and sometimes almost choleraic symptoms are caused by what seems a slight cause. Rheumatism is an occasional complication ; the connection between rheumatism and malaria is outside the present subject, so I will not discuss it.

Mania is also a not infrequent sequel, and has partly to do with the state of health, and partly with the high temperature. The higher the temperature, the more likely are the psychological centres of the brain to be injured, and disorders connected with them to follow.

The fœtus is, as a rule, not particularly effected, except in nutrition, and so suffers from fever at birth, only in occasional cases, and this is probably due to the resistent and destructive power of the placental structures which thus guard the entry of the fœtal area from deleterious matters. A similar result occurs in some cases of syphilis contracted during pregnancy.

"To use too many circumstances ere one comes to the matter is wearisome, to use none at all, is blunt," and I venture, therefore, to place the following cases before you to illustrate the circumstances which I have already reviewed :—

Case 1.—Malarious intermitttent puerperal fever.

Guya, a Hindu Brahmin, para. 1, aged 20, was admitted for slight fever on the 25th June 1892. Confined on the 29th June. Rise of temperature on the second day of the puerperium, which soon developed an atypical periodic character. No marked rigors. Antiseptic treatment and antipyrin were at first tried. On the eighth day quinine sulph., grs. xv., and the motions became frequent and dysenteric in character, while six round worms were passed. The round worms probably helped to set up irritation in conjunction with the other symptoms. The temperature also fell for a short time, but again rose the next day. Eucalyptus was then given internally, but with no appreciable effect, and quinine was again given by the mouth and the enteritis symptoms increased. Quinine was therefore given hypodermically with a gradual and satisfactory improvement. There was another slight rise on the thirtieth day of the puerperium, which also yielded to quinine injections, and the patient was discharged well on the 4th August. This chart shews well the persistence of the puerperal fever when accompanied by malarial complication and *vice versâ*, fairly regular intermittence, the irritative effect of the round worms under conditions of disease, and the irritant action of quinine by the mouth. So the hypodermic injections were resorted to. As strict antiseptic precautions were adopted, the chart also shews that unless the malarial fever is overcome, antiseptic precautions will not check the puerperal fever, which receives a continual fresh impluse from the malarial pyrexia.

Case 2.—Mild puerperal fever and malarious cachexia.

Two hourly chart.

Jai Babaji, Hindu, para. 9, age 40, admitted on the 25th.

The waters had escaped and the os was fully dilated on admission. The patient stated that she had been in labour for three days and that pains had been severe. Second stage prolonged, presentation vertex, second. The placenta was adherent and had to be removed by manual detachment. The case has the following peculiarities :—Some degree of traumatism from prolonged labour, and artificial interference at third stage, a consequent mild septicism and traumatic fever, and malarious intermittent fever with offensive lochia.

On the first and second days of the puerperium there was slight feverishness. On the third and fourth day marked fever. On the fifth day a sudden and acute rise of temperature of septic origin probably. This started the malarious organisms into active influence, and a daily intermittent temperature followed.

Quinine was not administered until the eighth day, and controlled the fever for a day or two. The lochia still continued somewhat offensive, and the fever recurred on the twelfth, thirteenth, fourteenth and fifteenth days. The quinine was steadily continued and arsenic was given on the seventeenth day. The patient was also treated with antiseptic uterine irrigations, ice-bag over the hypogastrium and uterine oxytoxics, and this local treatment, no doubt, controlled the effects of slight septicisim and traumatism. The quinine controlled the malarious fever well at first, but did not prevent recurrence. The effects were, however, aided by the arsenic, for the fever would otherwise have recurred after the nineteenth day, and the patient recovered completely. Without the antiseptic and antipyretic local treatment, the fever would have developed to a more serious degree, and quinine alone would not have had much influence on its course. At the same time I believe larger doses of quinine or hypodermic injections would have cured it quicker.

Case 3.—Puerperal and quartan intermittent fever.

Mrs. C., aged 30, European, para. 8, was admitted for puerperal fever. She had been confined twelve days before admission, and forceps had been used for inertia. The patient had been suffering for some time from mitral regurgitation, and there was a good deal of œdema and anæmia associated with the pregnancy. She had also been residing in a malarious district, and had had fever frequently. The fever developed in the third day of the puerperium, had been high and fairly continuous, and on some days had been much more severe than on others. As the patient's condition was desperate, she was brought to hospital. On admission she was in a very dangerous state, delirious with much dyspnœa and distress, and high fever. The treatment was at first directed to measures for reducing the fever, and the local puerperal congestion by an ice-bag to the hypogastrium and to the head, iced vaginal douches, ice pack, etc. The day after admission the temperature went up to 106°, and the patient's condition was most grave, her breathing being stertorous at the time of the highest rise, and she was cyanosed. On the fifteenth day the temperature went down, and the patient seemed much better, but on the sixteenth day it again rose to 106°, so that the chart gives the indication of a quartan type of fever. This second high temperature wave is accompanied by a rise of the pulse and respiration, which shew increased exhaustion and dyspnœa. Quinine, arsenic, and digitalis effected a cure. The slight rise of temperature of the 25th was transitory, and did not recur.

Case 3 A—This is supplementary to No. 3.

Mungula Govind, Hindu, aged 24 years, admitted 31st August 1894, suffering from anæmia, œdema and ascites, and in great distress. She was pregnant about six months. The liver was much enlarged, and so also were the glands of the neck, and there was a rise of temperature every evening. The patient improved much under treatment, principally of arsenic and quinine, and was confined on the 12th November 1894, labour being normal. The chart shews slight septicæmia from the fourth to the eleventh day of the puerperium, which apparently yielded to antiseptic treatment, but was followed on the twelfth day, and afterwards by an intermittent tertian fever, which did not yield to quinine by the mouth. When quinine was given hypodermically and liq. arsenicalis also prescribed, the patient had two deferred attacks of fever and then recovered.

Case 4.—Puerperal remittent fever.

Daiee Lalee, aged 35, Hindu, para. 6, admitted into hospital for fever. Temperature on admission 103° F. Pregnant at full term, and evidently much distressed. She had suffered from fever during pregnancy, but more especiplly during the last ten days. She complained of uterine pains. On the morning of the third day after admission, the pains became more severe, and she was confined the same day, the temperature being persistently high throughout labour. The notable points in the chart are as follows : The sudden fall of temperature on the second day after the quinine, grs. v., subcutaneously. The fall was very marked, and the temperature rose again on the third day to a very high degree after a rigor and remained high. The rigor probably indicated dilatation of the os. After confinement on the fourth day after admission, there was a very alarming fall of temperature after the administration of sodii salicylatis during fever and quinine sulph , grs. xv., no doubt due to the drugs, to exhaustion after labour, and to the usual fall of a temperature of the remittent type.

After this day of considerable danger, a condition of puerperal remittent fever was apparently established, and influenced here and there by the treatment. The effect of sodii salicylatis in depressing the temperature and vitality is marked and peculiar. The patient developed meningeal symptoms on the twenty-fifth day of the disease, to which she rapidly succumbed. Previous to this date, I think the chart shews that the fever was greatly controlled by the quinine given hypodermically. In spite of the severity of the case, the fever line does not range high during the last week, and the case might have progressed more favourably if the patient had not been exhausted by neglect and want of proper attendance before admission.

The treatment of these malarious puerperal fevers has been frequently shewn in the clinical memoranda. It consists mainly of unusually thorough antiseptic measures for the genital passages and uterine cavity, of general and local antipyretic agents, ice in various ways being particularly useful, and of internal antiseptics, while the malaria must be controlled by its specific drugs, quinine, arsenic, etc.

In desperate cases of hyperpyrexia, the ice pack and the immersion tank are of signal service.

The method of administration of quinine has received my particular attention, and I was so disappointed with it when given by the mouth, that I have almost abandoned it entirely. It is certainly of no use, except in large doses, but in puerperal septicæmia, I have pointed out that there is a potential irritability of the intestines which is likely to result in diarrhœa, and these large doses of quinine have invariably been followed by diarrhœa and even by enteritis, and if there is diarrhœa already present when the quinine is given, the drug may increase it, so that even severe collapse may follow. No one can doubt that quinine is an irritant to a certain extent to the digestive tract, for it will often cause dyspepsia, urticaria, gastrodynia and other symptoms of this kind. I therefore give it in large doses of 5 grs. or 10 grs. subcutaneously, and if the latter amount, it is well to have a couple of syringes charged with the solution to save time, the injections, of course, not being made too close together. This effect is seen in Case No. 1, in which quinine was given by the mouth on the eighth day and was followed by symptoms of enteritis. It had no effect on the fever, and probably there was not much absorption of the drug. When quinine was pushed hypodermically, the patient improved. The quinine does not exert an antipyretic influence to any great degree in these subcutaneous doses, but is probably more antiseptic and antiperiodic in its action.

The next series of puerperal fevers is that of the dysenteric form, which arises in connection with a true dysenteric attack. The dysentery itself generally originates during pregnancy, either at full term or earlier. In the former, labour, and in the latter case, abortion or miscarriage, is very likely to occur, and so we have a puerperal condition with the dangerous concomitant of very poisonous alvine discharges. Infection of the genital passages from these produces an extraordinary disease of the puerperal fever type.

Case 5.—Puerperal fever and acute malarious dysentery.

Yelloo, Hindu, Kamatty, resident of Parel, a malarious unhealthy suburb, was admitted into hospital on the 1st July 1892, suffering from dysentery, from which she had been ill for a fortnight. These facts were only elicited after she had been admitted into the general ward, and she was then isolated. Labour set in the day after admission, and was quickly over, the process being normal. Up to the time of labour, she had eight motions. They were scanty, containing a good deal of mucus. The progress of the case is indicated in an interesting manner by the chart, and I draw attention to the line of temperature record, which, for the first six days, does not range high. At the same time I think there was a fæcal infection, for there is during these days a distinct inclination to an apical temperature indicating slight puerperal fever. Also the number of motions increased greatly, and undoubtedly exercised deteriorative effect. On the twenty-second day of disease, the eighth after admission, there was a sudden and high rise of temperature. This was the result partly of puerperal fever, but no doubt it was to a large extent due to the malarious taint of which the dysentery was a primary expression. There were irregular recurrences for the next three days, until the 26th, when quinine sulph., grs. xx., having been administered by the mouth, the number of motions increased and the patient was collapsed. The hypodermic treatment by quinine was at once resorted to, and the result was satisfactory. This case shews conclusively how irritating quinine administered by the mouth in large doses is in such cases. At the same time, unless the malarious taint is overcome, the case is sure to go from bad to worse, nor will the dysentery yield until the malaria is subdued. Evidently the hypodermic treatment is the mainstay of these peculiar cases.

Case 6.—Dysenteric infection and puerperal fever.

This is an extremely interesting case. It was coincident with the case of Yelloo No. 5.

Mrs. W., Eurasian, para 1, aged 23, admitted on the 24th June 1892, for pregnancy at full term. She had suffered somewhat from morning sickness, and had œdema of the lower extremities. Labour set in on July 2nd, the same day on which Yelloo No. 5 was confined, and they were in adjacent beds. Labour was tedious and forceps were applied. There was some laceration of the perineum. On the third day of the puerperium, the patient was attacked with fever, which soon assumed a peculiar character, the patient being in an unusually prostrate state, and the bowels shewing a tendency to enteritis; antiseptic and other methods of treatment were adopted. On the fifth day diarrhœa set in, the motions shewing the character of muco-enteritis. On the ninth day, as the diarrhœa had not been quite so bad, quinine sulph., grs. xx., were administered by the mouth, with the alarming result shewn on the chart. The diarrhœa became violent and uncontrollable, and the effects were choleraic in their great intensity. After the patient had recovered somewhat, I began to give quinine subcutaneously and she recovered.

From these two cases, and from subsequent experience, I have observed that there is a particular form of puerperal fever associated with dysentery, the peculiarity of which is an increased tendency to elimination by the bowels, which may go on to actual enteritis, and that the fever is allied to the malarious intermittent form of fever. Possibly the infective agents of dysentery and malarious fever are analogous. It is certain that the decomposing products in the intestines would predispose the system to an infection of this kind, but their actual absorption into the blood is necessary for the development of puerperal fever from them, and this is effected through the genital passages.

Dysentery itself is very obstinate in pregnant women, and there are no doubt turgescence of the mucous membranes and changes in the circulation which make the disease persistent. It is also desperately resistent to remedies, so that a dysentery of an acute form in a woman near the end of pregnancy is peculiarly dangerous in this respect, as well as from the further risks of exciting premature confinement and of following up its primary havoc by an infection of the system with the fœcal toxines.

The most careful treatment often fails to prevent these consequences, and sometimes, when the case has taken a favourable turn, it is liable to relapse. Much may be accomplished by repeated large doses of ipecacuanha, opiates, sedatives, antiseptics, internally and externally, and ipecacuanha is sometimes very well borne, so that I have been able to give thirty grains twice a day. No treatment is effective unless the food is absolutely unirritating, and peptonized milk and lime water is the only diet that serves the purpose.

I have included an example of another series of cases, those of the syphilitic, because I have found peculiar results in the puerperal state in women who are strongly tainted with the specific disease.

Case 7.—M. M., aged 29, Hindu, para. 1, admitted in labour on 26th April 1894, and in consequence of a tedious second stage, vertex second, was delivered by forceps on the morning of the 27th. There had been no complication of pregnancy, but the patient had appearances on her body which indicated syphilis.

On admission the temperature was 102·5, and the pyrexia continued after delivery. The case was treated antiseptically for simple septicæmia, and somewhat improved, but again relapsed. On the twelfth day of disease pot. iodid. and pulv. santonin. were given with a gradual improvement, but the patient still remained feeble and prostrate and in bad nutrition until inunction of mercury was given on the twentieth day of the puerperium. The improvement then was rapid and satisfactory, and the patient was discharged well on the 11th June.

This case suggests many questions : Why puerperal fever should develope under such conditions, and whether it is puerperal fever, whether it is a climatic effect on the syphilitic patient, whether the syphilis stirs up an irritative fever in the system, or whether the syphilis renders the body more susceptible of septicæmia, and the septicæmia more persisent than usual until specific remedies are used. In cases of puerperal fever of a continuous type, associated with increasing cachexia, where the child shews also faint symptoms of congenital syphilis, it is always advisable to administer specific remedies. Of other forms of Indian puerperal fever the thermic is the one most frequently met with, and of course its main characteristic is intense and resistent hyperpyrexia. It is usually the sequel of pyrexia occurring before or during labour, although it may occur during the puerperal state, being most liable to happen on the third day in connection with the usual slight fever which results from any infection or lacteal disturbances on that day. It may be associated with puerperal eclampsia, and cases of this kind that occur without albuminuria indicate an intense congestion of the meninges. Complex cases of puerperal fever in association with other diseases of the pyrexial type must sometimes occur, and again, I repeat, if practitioners can give time to clinical records, we may hope for more knowledge of them. Busy men cannot do this of themselves, I know, but with the help of skilled nurses they may gain much useful information, and I would wish to impress upon the profession and the public how necessary it is that there should be an encouragement to the training of nurses of all castes and creeds, not alone for good clinical work, but for the greater work of a more assured wrestling with disease. It has always been the rôle of the profession to teach the public what it requires for its health's sake, and if every medical man would insist on his bad cases being properly nursed, I am sure the public would soon come to recognize how indispensable such nursing is. On our side of India there is certainly an apathy on the part of the public to good nursing in serious private cases that threatens shipwreck to the support of such a scheme which our nursing schools are trying hard to promote. Whether we are hospital physicians and surgeons, or whether we are in general practice, if we are united and earnest, if we are single-hearted and true to our noble calling in all these matters, we can each and every one of us strive to work for the general good in our own ways. In the selection of the evolutionary lines of our particular pursuits along this great scientific broadway of the most interesting, humane, and inspiring, though often most exacting, of life-tasks, we have much to be proud of, to reward and to encourage us, and many good deeds to do. At the same time let us bear in mind,—

"Ne let the man ascribe it to his skill
That thorough grace hath gained the victory.
If any strength we have, it is to ill,
But all the good is God's, both power, and eke will."

VOTE OF THANKS.

Dr. Moses proposed a vote of thanks to the Chair.

Dr. Sarbadhicary seconded the resolution.

The vote of thanks was carried unanimously.

DISCUSSION.

The President, at the request of the meeting, gave a definition of his mode of treatment of puerperal fever complicated with malaria. On reviewing the subject of his presidential address he had given the main points of the treatment of such cases, which consisted of the treatment of a septicæmic element and of the malaral cachectic element. For the former frequent irrigation of the uterus by hot water, with or without antiseptic agents, was employed. There was a liability in these cases of malarious fevers in the puerpera to the development of what seems to be an autogenetic form of puerperal fever, *i.e.*, the lochia and discharges in the uterus have a tendency to decomposition, and so to an absorption of the products into the system. By frequent irrigation of the uterus the pyrexia due to the septicæmic element of the case can be reduced. The malarious element can then be brought under control by hypodermic injection of quinine. The President gave as much as ten grains, morning and evening, in this way. Should the fever be still resistent, arsenic in full doses must be given. These cases cannot afford to be temporised with.

Rakhal Das Ghosh (Calcutta) attributed cases of puerperal fever in private practice to infection by nurses or the neglect of ordinary sanitary precautions. In his experience quinine had been found most useful, both in combating the malarial taint and in influencing the course of the septicæmia. He drew attention to the value of large doses of ipecacuanha in puerperal fever with dysentery, save in those cases of females, who are much debilitated by the disease. In these cases opium, kurchie, extract of bael, etc., are most useful, followed later by bismuth with Dover's powder. Locally intra-uterine irrigation must be carried out efficiently.

Rajendra Nath De (Calcutta) concurred in the value of quinine in large doses for the conditions described by previous speakers.

Jogendra Nath Ghose (Calcutta) was of opinion that in cases of septicæmia, uncomplicated by malarious fever, quinine in big doses was of little avail. He mentioned a set of cases which had continued for several months. In some of these he stated that a temperature of 118° had been observed. In these cases thirty or forty grain doses of quinine were given without much avail.

Joubert (Calcutta) agreed with the President with regard to the influence of the malarial taint in lying-in-women.

In this respect there is a great difference in the significance of a sudden rise of temperature between women recently confined in India and in Europe. In the latter it is usually the indication of some grave trouble, with women in India, it may merely mean an attack of malarial fever. But this rise of temperature in puerperal women in India must certainly appear to render them more liable to the subsequent invasion of septic poison. Dr. Robert Barnes, even in England, advises the use of quinine for some days after labour in combination with ergot as a general and uterine tonic, and it is more particularly useful in India when the malarial taint present in almost everybody has to be met and provided against. Dr. Joubert mentioned how frequent "fever in puerperæ" is in the cases coming to the Eden Hospital, Calcutta, for confinement. Many cases have fever before their labour commences ; many are admitted in labour with fever on them ; many develope it shortly after labour. All these cases are peculiarly liable to become septic, and for this reason it is the routine practice at the Eden Hospital to put all labour patients on a mixture containing ergot, quinine and digitalis. If the lochia became at all abnormal, the uterus is at once washed out with hot water, followed by a 1 to 60 solution of carbolic acid. The results are very good, for rarely does a severe case of septicæmia (puerperal) occur in hospital. Many cases, however, are admitted already septic, and in many of these cases continued intra-uterine irrigation is given with very good results. Cases are often brought to a successful issue when this continued irrigation has been kept up for days. The method was described by the speaker.

OBSERVATIONS ON SYMPHYSIOTOMY.

BY H. P. DIMMOCK,

Surgeon-Major, I. M. S.

Since I performed my first case of symphysiotomy, which was read before the Bombay Branch of the British Medical Association in 1892 and is reported in the journal, I have, during the years of 1892-93-94, done the operation eleven times, all of which have been successful as far as the mother was concerned, although the pelvis was in some cases much more contracted than is in accordance with the canons which I now consider to indicate the operation. A table of the cases is herewith appended, and I will enumerate a few of them for special exemplification. My second case was performed, during labour, by what I now term the open operation of symphysiotomy, that is, an incision made through the superficial tissues down to the joint, which is then divided from below upwards.

The true conjugate diameter of the pelvis was slightly under three inches, but the child died, asphyxiated, after delivery, a result mainly due to the delay in bringing the patient to hospital, when the head of the child had been arrested in the pelvis for some time.

In this case the anterior fourchette was lacerated, giving rise to excessive hæmorrhage, and an abscess subsequently formed in the abdominal wall, but the patient made a good recovery, and came up to hospital afterwards in perfect health. She was quite well and strong, and although the symphysis had been completely divided, she walked firmly and easily, and the joint had united well.

After doing this case, I was impressed with the danger of subsequent infection of the wound by the lochia, which occurred in spite of the greatest care owing to the restlessness of the patient. I therefore determined to try subcutaneous section of the symphysis, and accordingly did so in the next two cases, the particulars of which I will now relate. Pherozbai Mistry, a Parsi Multipara, aged 27, was admitted into hospital on the 17th May 1893, and gave the following history :—

Her last menstruation occurred some time in October 1892, and she suffered from severe vomiting in the first four months, but had no other complication.

She had two children, one seven years ago, a daughter, still-born at full term. The confinement was prolonged over two days, and on the third day the funis prolapsed, but no instruments were used. In the puerperium she had fever and pain in the hypogastrium, but relates nothing else of importance.

The other child was born three years ago, a son. In this confinement, she came into hospital at full term, having laboured two days. There was prolapse of the funis, and she was delivered under chloroform with the aid of instruments—perforation. Present condition: She is a small woman of stunted ricketty growth, and her right thigh is deformed by a fracture sustained in her youth. She is anæmic, and her feeble state does not give hope of success from Cæsarean section.

The fundus uteri is twelve inches above the symphysis, globular in shape, and projecting unduly, and the fœtus is in the first position.

Measurements of pelvis.

Il. cr. ...	$10\frac{1}{4}$ in.	Il. sp. ...	10 in.
Intertroc c. ...	$10\frac{1}{4}$ in.	Ext. conj. ...	$5\frac{3}{4}$ in.
Diag. conj. ...	3 in.	True conj. ...	$2\frac{1}{2}$ in.

Evidently, either the period has been miscalculated, or the fœtus is small and ill-developed, which latter I think most likely from the previous obstetric history. I determined to induce labour at once and then to perform symphysiotomy and version, as without symphysiotomy I could not pass my hand into the pelvis.

As soon as labour had set in, I proceeded to dilate the cervix with Barnes's bags, and as soon as the dilation was complete, I divided the symphysis subcutaneously. The presentation was first position, vertex.

The amount of room gained was apparently as much as I could have had by the open method, and I could just pass my hand into the uterus and turn with difficulty. The general contraction of the pelvis, however, was such as to prevent free delivery of the head, and the child perished.

The patient made an excellent recovery, and was discharged on the 23rd June, able to walk freely and easily, and with no pain or yielding of the pelvis. She was advised to be careful and to keep quiet for some time.

The history of the second case of subcutaneous symphysiotomy is as follows :—

Fatima Mahomed Khan, a Mussalmani Multipara, aged 33 years, was admitted into hospital on the 7th August 1893, being about the eighth month of pregnancy.

(*N. B.*—Native patients can give no dates).

She has a daughter ten years old, and about two years ago she was admitted for difficult labour into the obstetric ward, when craniotomy was performed. She is anæmic, thin and feeble looking, of peculiar gait and carriage, but has felt well during the whole of her pregnancy. She had come up to hospital to place herself under treatment, in consequence of the previous difficult labour and my recommendation at that time. The uterus is globular, tense and projecting, and the fœtal position cannot be made out, nor the fœtal heart-sounds detected.

On vaginal examination, the pelvis is found to be so contracted by osteomalacia that the fingers cannot reach the cervix, and the presentation cannot therefore be observed. The promontory of the sacrum is much

No.	NAMES.	Age and No. of pregnancies.	Date of operation and discharge.	Nature of operation.	Result to child.	Result to mother.	REMARKS.	MEASUREMENTS OF THE PELVIS.						MEASUREMENTS OF CHILD'S HEAD.						
								Iliac crests.	Iliac spines.	Intertro chart.	Ext. conj.	Diag. conj.	True. conj.	O/M	O/F	S/O/B	Bi./P	Bi./I	M/F	
1	Radha Narayan ...	22/Nil.	22-12-92/6-3-93	Symphysiotomy by exposure of joint	Craniotomy	Uninterrupted recovery.	This was my first case. The patient was suffering from mollities ossium. I tried to wire the pubic rami. The bones being soft, cut through easily. The case was left to nature by keeping the parts in apposition with a a strong binder. The case progressed very favorably.	8½	8	8½	6	2½	2			Cranio	tomy			Osteomalacia.
2	Benbai Luximon ...	20/Nil.	15-3-93/22-5-93	Forceps, symphysiotomy by exposing joint and forceps.	Died ...	Recovery ...	There was laceration of the posterior and anterior vaginal wall, which were satured. Abscess formed and drainage applied. Progressed slowly, and did well.	9½	7½	10½	7	3¼	Transvers 1¾	5½	4¾	3½	3¼	3	3	Rickets.
3	Perozbai Mistry ..	27/2	24-5-93/23-6-93	Labour induced at 8th month. Subcutaneous symphysiotomy. Int. podalic version.	Died ...	Recovery ...	This is my first case by the subcutaneous method, and it is undoubtedly a better operation. No risk of septic absorption as in the open method. Patient made an uninterrupted recovery, the bones being approximated very nicely.	10¼	10	10¾	5¾	3	2½	4½	4	3¼	2¾	2½	2½	......
4	Fatma Mahomed Khan ..	33/2	26-8-93/29-9-93	Subcutaneous symphysiotomy and forceps.	Died ...	Recovery ...	Did very well. Uninterrupted recovery ...	8¾	8½	9	7	1½	1	3¾	3½	3¼	3	2½	2½	......
5	Kasi Hari	35/2	10-9-93/26-9-93	Forceps, podalic version, subcutaneous symphysiotomy.	Craniotomy	Recovery ...	Do. do. ...	9	8½	10	6	2½	2			Cranio	tomy			
6	Fatmabai Aba	26/4	24-3-94/23-4-94	Subcutaneous symphysiotomy and forceps.	Alive ...	Recovery ..	Do. do. ...	8¾	8	......	......	.. ...	......	4¾	4¼	3¼	3	2¾	2¾	Pseudomalacosteon.
7	Mukta Luximon ...	30/3	6-3 94/28-3-94	Forceps, subcutaneous symphysiotomy. Int. podalic version.	Alive ...	Recovery ...	Do. do. ...	9¼	8½	10⅛	6½	3¼	2⅜	4¾	4¼	3⅛	3¼	3	3¼	......
8	Hammunbai	22/3	3-5-94/14-6-94	Subcutaneous symphysiotomy. Natural delivery.	Alive ...	Recovery ...	Do. do. ..	8⅜	7½	9½	7¼	3	2½	5	4¼	3¾	3¾	3⅓	3¼	Osteomalacia.
9	Ramabbai Mahomed ...	15/Nil.	7-5-94/14-69-4	Induced labour 8th month, subcutaneous symphysiotomy. Natural delivery.	Dead ...	Recovery ...	Scrofulous patient. Admitted with a large mammary abscess, which caused much wasting of flesh. Rickets as well as mollities ossium (dwarf.)	0½	7¼	......	5	......	......	3	3¾	2¾	2⅜	2⅓	2¼	Pseudomalacosteon.
10	Radhi Bhagotti	30/3	29-6-94/26-7-94	Subcutaneous symphysiotomy ... (Footling case).	Alive ...	Recovery ...	Did very well. Uninterrupted recovery ...	10¼	9¼	10½	8¼	......	1¾ Transverse 1 inch.	5	4	3	3½	2½	3½	......
							PATIENTS NOW IN HOS	PITAL.												
11	Unknown Deaf and Dumb ...	35/1	27-9-94	Induced labour, over 8th month. Subcutaneous symphysiotomy.	Craniotomy	......	Progressing favourably	9½	9	8	7½	2½	1¾			Cranio	tomy			
12	Perozbai Jamsetjee ..	30/Nil.	29-9-94	Forceps. Subcutaneous symphysiotomy	Craniotomy	......	Progressing favourably	......	......	......	......	......	......			Cranio	tomy			
13	Rathuja Abdool Khadar ...	22/4	28-8-94	Subcutaneous symphysiotomy, forceps Int. podalic version. There was ample space for an ordinary sized head after craniotomy.	Perforation of cranium, slight hydrocephalu	......	Progressing favourably. Has been in an unhealthy condition of body. Recovery delayed from bedsores.	8½	7	5¾	7	......	2½	5	4 Laid-he	...... Cranio ad hydr	...... tomy ocephali	...... e	3	Rostrated pelvis.

N B.—The small conjugate diameters of the osteomalacic pelves are due to displacement of the sacral promontory forwards O ; sometimes they could only be measured after labour on account of approximation of the tubera ischii and rami of pubes and ischium.

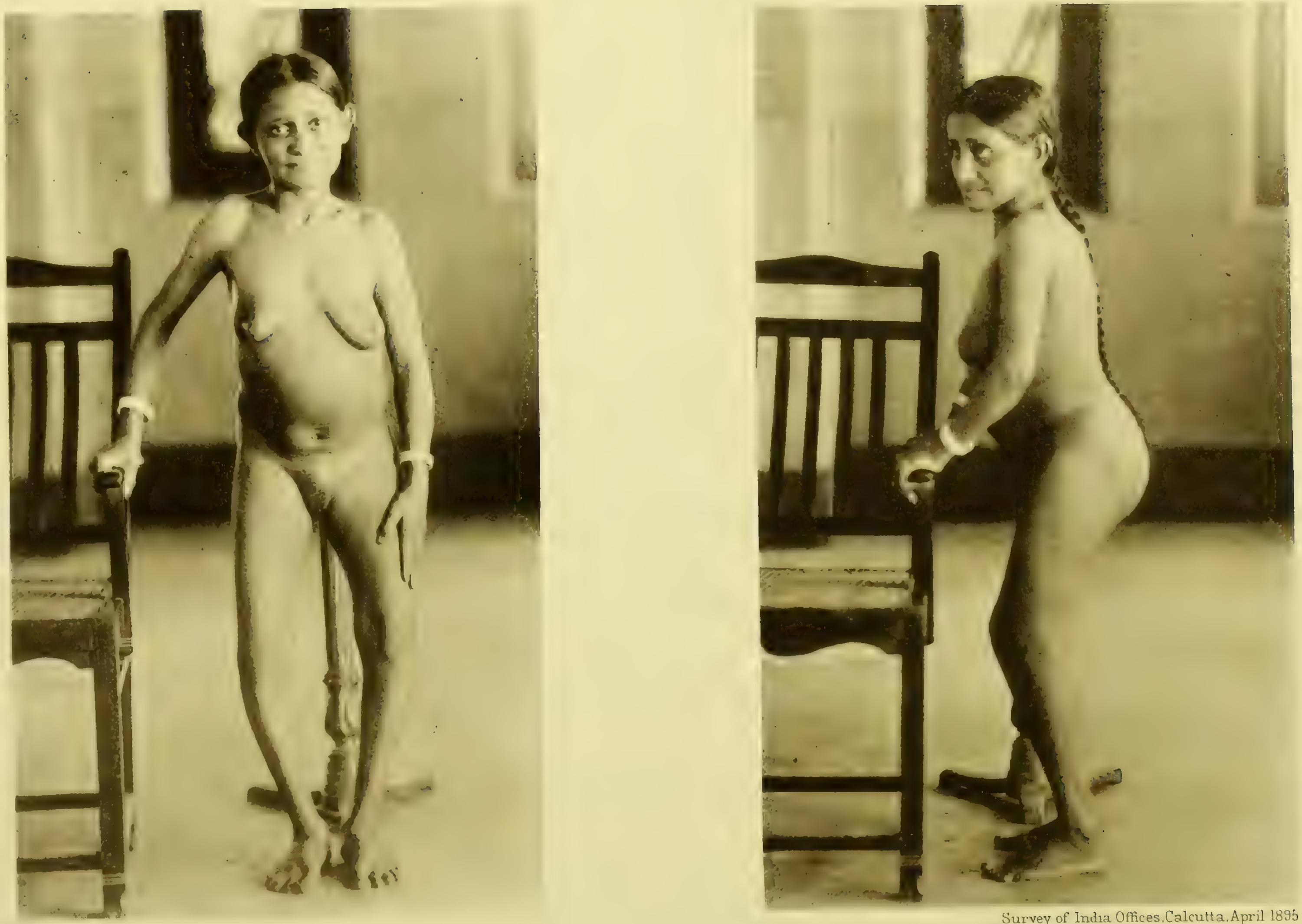


Photo-etching

Survey of India Offices. Calcutta. April 1895

CASE II.

HAMIMBI-MUSSALMANI

displaced forwards, so as to resemble a case of spondylolisthesis.

The sacrum is greatly curved and the coccyx directed forwards, encroaching much upon the outlet of the pelvis, the tubera ischii are approximated so as to admit one finger only between them, while the descending rami of the pubes are quite close together for the greater part of their length.

It was evidently a case of extreme osteomalacic contraction of the pelvis, probably following on the birth of the first child, who is now alive, and being exaggerated during the present pregnancy. I think that in most cases the disease recrudesces during subsequent pregnancies.

Measurements of pelvis.

Il. cr. 8¾ in.	Il. sp. 8½ in.
Intertroc c. 9 in.	Ext. conj. 7 in.

Diagonal conjugate, measured from the tubera ischii to the displaced promontory about two inches. The case was considered to be more suitable for Cæsarean section, and this was represented to the woman and her husband, both of whom objected to the operation, and wished the child to be delivered by the natural passages, even if it were mutilated in the process. Embryotomy was out of the question, as there was no space to use the instruments, and the uterus could not well be reached. Section of the joint was accordingly done on the 25th August 1893. This was unusually difficult, owing to the joint surfaces having expanded greatly, so that the length of it measured about two inches.

The joint surfaces separated to fully ¾ inch when section was fully completed, the tubera ischii also separated so as to admit three fingers instead of one, the hand could be inserted into the vagina and the cervix could be easily reached. The results were so encouraging that I simply passed a bougie to induce labour and put the patient to bed. The presentation was first position, breech.

25th August.—Morphine injection gr. ¼th at 10 A.M. Complains of a certain amount of pain and some tenderness over the symphysis, but it cannot be ascertained how much of the pain is due to labour.

In the evening there was irritative fever and the bougie was removed. Hot vaginal douche every fourth hour.

26th.—Injection morphine ⅙th gr. 11-30 A.M. Chloroform administered and a small Barnes's bag introduced. 3-30 P.M. as fully dilated.

4-50 p.m.—Membranes ruptured artificially after waiting; the breech was found to be delayed by the projecting coccyx. Traction was therefore made on the groins, and after some difficulty and manipulation a living male child was delivered, the head passing through the outlet, transversely almost, on account of the coccyx.

The child was 15½in. in length.

Measurements of head.

O. M.	O. F.	S. O. B.	BI. P.	B. T.	F. M.
3¾	3½	3¼	3	2½	2½

Circumference, 10½ inches.

It died of asphyxia about an hour after birth, the cord having evidently been much compressed during delivery.

The mother had violent post partum hœmorrhage before the placenta was delivered, and this had to be treated by artificial removal. Manual compression of the uterus, hot uterine irrigation and ergotin hypodermically.

By the increase of space obtained by the operation, I was able to do all this satisfactorily and with ease.

She was then put to bed, an ice bag applied over the hypogastrium, and ice to the vagina.

For the first 48 hours vomiting and meteorism were very distressing, but gradually subsided.

30th.—Inflammation of the lymphatic vessels in the right iliac region.

2nd September.—Purulent discharge from the puncture in the skin, which is evidently due to septic infection, probably occurring during the operation. It, however, subsided in a short time, and the patient made a good recovery.

After some further experience, I decided that if labour had not set in, or the operation were decided on at an early month of pregnancy, I would always first perform subcutaneous section of the symphysis, and proceed at once to rapid dilatation of the cervix, and complete delivery in as short a time as possible, keeping the patient under the influence of morphine until the second stage was well advanced, when it would be necessary to administer chloroform again.

I submit two other cases, one of which, Rahimatbi Mahomed's II, is another example of this way of operating.

Hamimbi, Mahomedan, aged 22, iv, pregnancy, was admitted into hospital on the 17th April 1894. The first three children are all dead; the first labour was normal, but the child died; the two subsequent ones were conducted in hospital, with operative interference under anæsthesia, and the children perished—a history which seems to show osteomalacia with the first pregnancy, affecting the following ones. The configuration of the patient has some resemblance to rickets, in the small stature and bending of the tibia, but the pelvic deformity is distinctly osteomalacic. I have for long thought that some of our bad cases of rostrated pelvis in Bombay were due to osteomalacia superimposed on ricketty bones, though, indeed, osteomalacia in pregnant women is terribly prevalent amongst the crowded poor of our city, whose humid climate, low lying ground, terrestrial and drainage exhalations are never forgotten when once experienced.

Diagnosis of presentation—breech first, pains set in naturally at 10 P.M. On the 2nd of May, water escaped at 11-45 P.M., as fully dilated at 2 A.M. on the 3rd, when subcutaneous symphysiotomy was done. Labour was completed naturally at 3 A.M., the placenta following the child at once. There was some postpartum hœmorrhage, which was controlled by manual compression, ergotin and hot irrigation

The symphysis joint surfaces separated about one inch after section.

The case progressed favourably, as seen by the chart, and the patient was discharged well on the 14th June 1894.

The after treatment adopted was an ice bag over fundus, iced vaginal douche, vaginal swabbing with carbolic lotion 1 to 20, quinine, morphine, diaphoretics, santonine, and ecbolics.

Rahimatbi Mahomed, Mahomedan, I confinement, age 15 years, (?) was admitted into hospital on 17th March 1894 for a large submamary abscess, which was treated by incision and drainage on the 21st March 1894. She also had scrofulous enlargement of the glands, was deformed to a lamentable degree by rickets, was in a most feeble state of health, and pregnant about six months.

After she had recovered strength somewhat by rest and treatment of various kinds, the question of delivering her safely on account of the extremely distorted pelvis was taken up.

On Sunday, the 6th May 1894, at 10 A.M., subcutaneous symphysiotomy was performed and labour induced.

When she recovered from the anæsthesia she was kept under morphine.

She complained of pain in the symphysis throughout the day, and towards evening of pain in the back. Labour set in at 5 A.M. on the 7th May, and was completed at 6-45 P.M. on that day. On account of the feeble pains and the distorted outlet, the head was delayed at the ostium vaginæ, and the child was asphyxiated.

The chart shows the progress of the case. She was discharged well on the 14th June 1894.

Method of operation for subcutaneous symphysiotomy.—This operation, which I have never seen described elsewhere, I perform in the following manner:—

After thorough cleansing and other antiseptic precautions, a silver catheter is passed into the urethra, and the urethra is then held downwards in its entire length by an assistant.

Standing between the patient's legs, which are supported by assistants, I pass a sharp pointed tenotomy knife obliquely just to the under surface of the symphysis, the point entering the skin just above the base of the clitoris at the point of division of the labia majora.

The incision is enlarged subcutaneously on withdrawal of the knife by pressing the cutting edge towards the symphysis.

A strong blunt pointed curved bistoury is then passed into the incision and section through the point completely effected, carefully, gradually, and quite subcutaneously from below upwards and forwards.

The pubic bones generally separate to quite half inch at once, and yield still more with the passage of the child, so that in some cases I have been able to lay about the breadth of a finger and a half or two fingers in the space between.

The most astonishing result of the operation, however, is seen in cases of osteomalacia, in which I have sometimes only been able to pass the tip of one finger between the approximated tubera ischia. After division of the symphysis, these part to such an extent that I have been able to pass two or three fingers between them, and by force and the passage of the child have been able to separate them even further, so that a very great deal of space is gained at the outlet. The space at the brim is also much increased, especially in the lateral measurements of its anterior half. In cases of pseudomalacosteum rickets and true malacostea, the pelvis is always so irregularly distorted that it is impossible to gain accuracy in the estimation of the space available for delivery of the child.

There is usually free spouting of venous blood up through the small incision, which quickly ceases, and is no doubt from the venous channels around the joint.

Sometimes a hæmatoma forms in one or other labium, but is soon absorbed. The after treatment is more simple than in the open method, as there are no dressings. The incision is sealed with antiseptic wool and collodion, the hips are kept tightly bandaged to approximate the joint surfaces, and the thighs are tied together, the patient being disturbed as little as possible. Union of the joints takes place quite satisfactorily, and I believe it to be of a fibrous character.

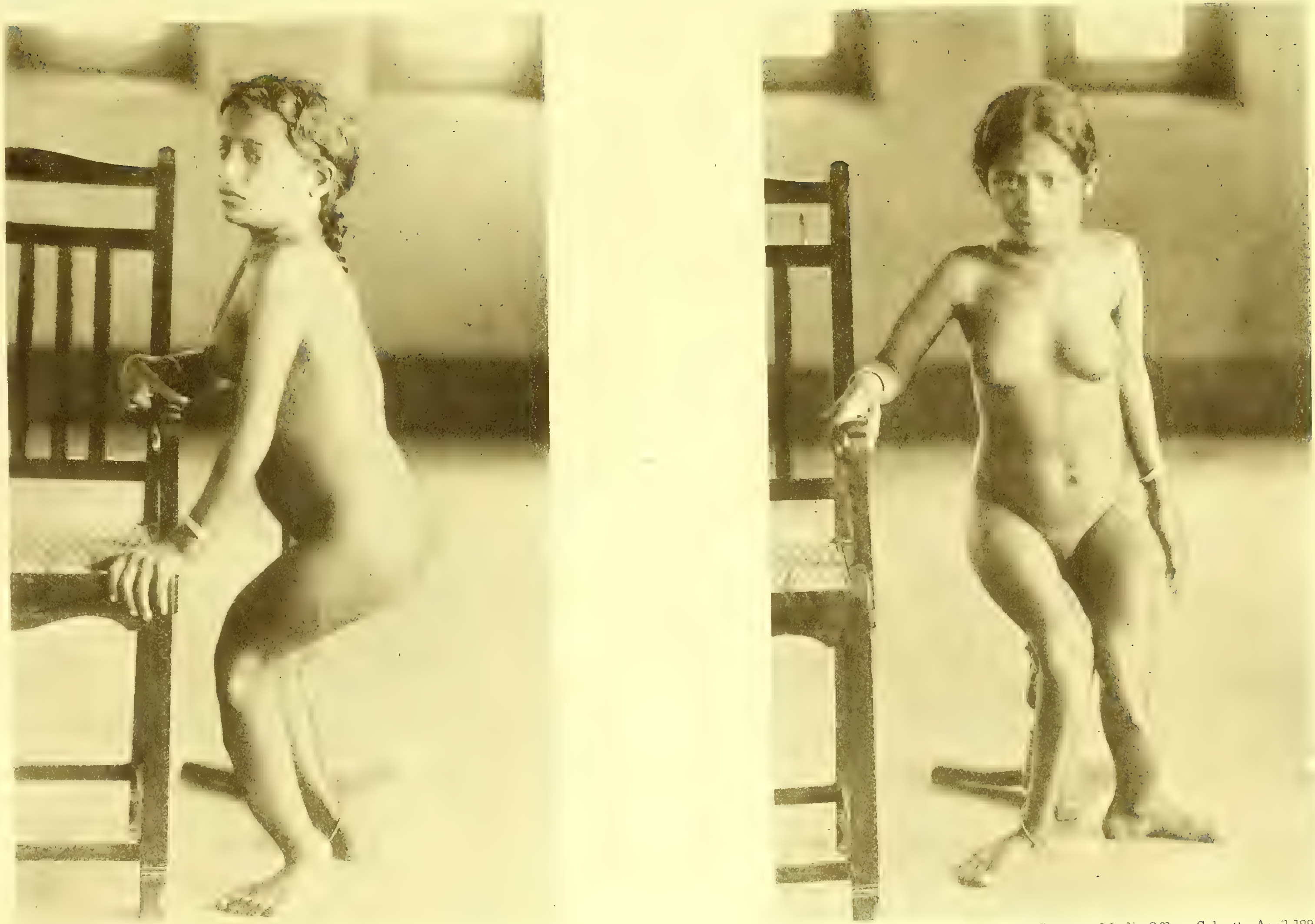
My reasons for performing symphysiotomy in most of the cases have been the extremely feeble condition of the patient, and the delay in seeking skilled aid, until labour is far advanced, both of which conditions would be prejudicial to the recovery of the patient from Cæsarean section.

Those who are familiar with the condition of patients suffering from osteomalacia must have observed the suffering consequent on the crippled state, the pains in the bones, and the low state of health of these patients. The bones of the pelvis and the femora are frequently so distorted that the patient is unable to walk, and the tenderness of the bones and tissues is sometimes so great as to make any movement acute pain.

Most of us have read of the various modifications of this operation, which have been plentifully reported from Italy, Germany, and America, and the results have been freely discussed.

There is a strong opposition to the operation in England and elsewhere ; but I think it is gaining ground in all countries as a recognised operation in certain cases. Professor Pinard, of Paris, has especially contributed some wonderful cases and varieties of the operation, particularly with reference to ricketty pelvis, so that we have choice of the methods,—the open incision, the subcutaneous section, the pubo-ischiotomy, and other methods of dividing the bones.

With regard to the open method, should I ever again perform it, I would prefer to make the incision transversely, not vertically, as greater freedom would be gained by this means for the various steps of the operation.



Photoetching.

Survey of India Offices, Calcutta, April 1895

CASE I.

RAHIMATTI-MUSSALMANI.

DISCUSSION.

Staley (Delhi) pointed out that symphysiotomy as compared with Cæsarean section was a much simpler operation if the same end was obtained. Among natives, who have such strong prejudices against operation, symphysiotomy would prove of the greatest value, as it was so unobtrusive in its performance and the consent of relations was correspondingly easily gained.

S. P. Sarbadhikari, with reference to the after-effects of division of the symphysis, related the case of a deformed pelvis in a woman of muscular build. During labour, muscular contractions were very powerful. After delivery, it was found that the two rami moved freely one on the other. The hips were strapped together tightly. In six weeks the woman was moving about on crutches. In two months she could walk just as well as ever.

Namer Prasad Dogchi (Agra) considered that in cases of contracted pelvis, when a living child cannot be born *per vias naturales*, Porro's operation was preferable, as it gave a very good chance both to mother and child. At Agra, as far as he could remember, the mortality of mothers from Porro's operation was one in five. Unfortunately many of the cases come into the surgeon's hands when it is all but too late. In extreme cases of contraction, symphysiotomy would not give sufficient space for the birth of a living child, and moreover the bruising of the maternal soft part must be considerable.

Dr. Joubert (Calcutta) said that the meeting must be much obliged to Dr. Dimmock for his interesting paper. Bombay seemed to present more opportunities for the performance of the operation than Calcutta. In his own experience at the Eden Hospital, Calcutta, since 1888, he had only met with one case of extreme contraction of the pelvis. The results given in the paper did not appear favourable to the child, for there were nine deaths in thirteen deliveries. On the other hand, the recovery of all the mothers give an amount of success, which could not have been obtained if Porro's operation had been done in all the cases.

OVARIOTOMY IN AN OUTSTATION.

BY F. S. PECK,
Surgeon-Major, I. M. S.

It is with some diffidence that the cases which are about to be described are brought before you to-day. Modern ovariotomy has been rightly designated the greatest triumph of the surgery of the present day. Its history is so closely connected with so large a number of illustrious names, and with so bright a record of brilliant success, that the narration of a few cases, doubtless in many instances marred by the blunders of a learner, and by results by no means up to the standard of the success at present obtained, may seem out of place and superfluous. It has, however, been brought forward as illustrating the difficulties under which surgeons labour in small stations up-country, and with the hope that the experience therein described may prove of some slight assistance to others who are similarly situated. Briefly fourteen cases are recorded, the operations extending over a period of seven years The first two cases were operated on in the Chupra dispensary, the remaining twelve at Mozufferpore, all cases presenting themselves were operated on and none were rejected. The patients were all natives and of various castes and religions. Four of the fourteen cases terminated fatally, and high as this percentage of failure is, it is doubtful whether it could have been avoided or improved. The successful cases have mostly been under observation for months and years, and the results have been satisfactory in every particular. The conditions under which these operations have been performed are such as will astound and dismay the surgeon accustomed to operate in a well-appointed European hospital, fitted with every appliance that modern science can suggest for minimising the risks and dangers attendant on big surgical operations, and supplied with a skilled staff of nurses and dressers eager to leave nothing undone that might conduce to the recovery and welfare of the patient.

In the first place it cannot be denied that the conditions of climate, comprising, as they do, high temperature, a continuous and protracted rainy season with at most times of the year great daily rises and falls of the thermometer, are not conducive to the favourable treatment of surgical cases.

The patients, almost without exception, were vegetarians, and accustomed to live on the minimum amount of food with which life could be sustained. They were poorly clad, badly housed, often debilitated by diarrhœa and dysentery and saturated with malaria. On the other hand they were accustomed to a hardy outdoor life, and were not degenerated by an excess of rich nitrogenous foods and by the abuse of alcohol.

Hospital accommodation was poor in the extreme, the hospital itself being an old building, made with unburnt bricks and mud plaster, originally used as a dwelling-house. The plinth was only about eighteen inches from the ground, but the roof was lofty and water-tight, a small verandah room with a thatched roof was the only place available as a special ward for the treatment of these cases. In the absence of a sufficiently well-lighted operating room, it was found necessary to perform all surgical operations in an open verandah at the back of the building, screened from observation by the compound walls.

With the exception of the first two operations, for which Dr. Harvey, then in charge of the Eden Hospital, kindly lent his ovariotomy case, the special instruments used were limited to half-a-dozen fixation forceps and an ovariotomy trocar. The silk for tying the pedicle and for the ligature of vascular adhesions was the same as supplied to the Eden Hospital.

The nursing, until within the last two years, when a native nurse trained at the Eden Hospital was added to the establishment, was in the hands of the patients' friends, the hospital methranee, and the ward coolies; these, however, were most carefully supervised and directed by the assistant surgeon.

The operations were performed with the able assistance of the assistant surgeon, and such hospital assistants as happened to be on duty in the station at the time. The instruments were carefully sterilised by boiling, and being placed in an antiseptic solution. The silk used, after having been boiled, was carbolized by being dipped in a mixture of carbolic acid and wax; a solution of perchloride of mercury 1 in 10,000 was used for irrigating the abdominal cavity and for the cleansing of hands, instruments, and sponges during the operation. Sponges were carefully boiled and kept in perchloride solution. The sutures consisted, in the earlier operations of silk, silver and horse-hair; in the later operations, of silkworm gut. The incision was dressed in every case with iodoform, a thin piece of muslin covered with boracic ointment made with vaseline and paraffin, a layer of boracic lint and a thick pad of sal alembroth wool, the whole being kept in place by a sterilized flannel bandage. In only two cases did the wound become septic, and in each of these cases a small septic abscess formed in the track of one of the silk sutures, and in neither case was the final result prejudiced thereby. In none of the successful cases was it found necessary to use a drainage tube.

From the tabulated statement of the cases, which has been circulated to-day, it will be seen that of the four fatal cases three died of shock within an hour or two of the operation. The fourth fatal case was that of the woman Paroo, who died on the fifteenth day from dysentery after the incision had united, and the ordinary dangers of the operation had been survived.

Case 7.—The woman, Goodhni, was an instance of a desperate operation on a suppurating cyst. It is doubtful whether this operation should have been undertaken, but, after anxious consideration, it was decided to be justifiable to give an extreme chance to this poor woman who was in a moribund condition.

The cyst cavity was found to be full of a foul suppurating fluid, with large masses of sloughing tissues floating about in it. The cyst wall was firmly adherent in every direction and so rotten that it tore through wherever any attempt was made to break down the adhesions. The contents of the cyst were evacuated and portions of the cyst wall removed. The abdominal cavity was closed with silk sutures after having been washed out with perchloride solution and drained. As this operation was undertaken as a last resource in a desperate case, the result ought not to be included in a mortality percentage.

Cases 3 *and* 5—Illustrate how absolutely impossible it is before operation to decide the extent and nature of adhesions. The ordinary diagnostic methods did not excite any suspicion that adhesions of extraordinary character and extent existed. However, on opening the abdomen in both cases, it became apparent that the cyst wall had become so intimately adherent to all the surrounding structures as to be part and parcel of their integral substance. In the one, the cyst wall was separated out and removed, leaving the abdominal cavity one vast bleeding surface. In the other, it was found to be an absolutely mechanical impossibility to remove the cyst at all. Both the patients died within a few hours of operation. Thus, it will be seen that by eliminating case 7 as an operation on a suppurating cyst and case 10 as a death from an accidental attack of dysentery that the mortality is reduced to two in twelve or some sixteen per cent. The two remaining fatal cases may fairly be considered absolutely unavoidable, owing to the nature and extent of the adhesions, of which no adequate diagnosis could be made.

Amongst the successful cases the one most worthy of note is No. 11, the woman Sharunia. This patient was brought in from the Nepaul frontier of the Mozufferpore District. Her appearance, when first seen, was appalling. She was sitting on the ground, her legs stretched out straight in front, her back resting against a wall, and an enormous mass protruding in front of her so far as to conceal her knees and nearly half of her legs from view. On measurement the circumference at the navel was found to be sixty-two inches. The patient was a woman of forty years of age and spare of body. She asserted, in a most positive manner, that she had noticed nothing wrong until about eighteen months previously, when she perceived a small painless swelling in the right side of the abdomen. She had not menstruated for nine months and had been the mother of nine children, of which the youngest was some ten years of age. The urine was found to contain traces of albumen, the legs were œdematous and the respiration was purely thoracic. After a few days under observation operation was decided on, and performed on the 16th of April 1892. The patient was placed under chloroform, and an incision, about four inches long, was made in the medium line of the abdomen, commencing from a little below the umbilicus. On opening the peritoneum, soft adhesions of the cyst wall to the parietes were easily broken down with the hand, as far as could be reached, an ovarian trocar was inserted, and a dirty glairy fluid evacuated. There were no adhesions to any of the internal organs, and the cyst proved to be unilocular. As soon as it collapsed, it was easily delivered through the abdominal incision. The pedicle, which was narrow and long, was then transfixed by a needle, armed with strong carbolized silk, tied with a Staffordshire knot, and divided with scissors. Eighty-three pints of fluid were evacuated and the empty cyst, which contained very little solid matter, weighed 2lbs. 4oz. The abdomen was washed out with perchloride lotion, and the incision closed with silver wire, deep sutures and horse-hair superficial ones. The appearance now presented by the patient was extraordinary. The abdominal wall loose and flaccid lay back against the spine, the base of the thorax covered by the parietes stood out like the head of a big drum with the lower half of a woman's body protruding from its periphery. The wound was dressed in the usual way, and she made an uninterrupted recovery. The temperature never rose above 101°. The albumen disappeared from the urine, the thorax gradually returned to its normal size and position, and with the exception of slight hepatic pains, she never complained of any discomfort whatever. The dressings were changed on the fourth day and the sutures removed on the sixth, by which time the incision had united. She left hospital exactly twenty-four days after operation, but was really fit to go on the eighteenth day.

This case is phenomenal in regard to its size, as it is believed to be nearly twice as large as anything that has hitherto been recorded; it is instructive as illustrating the fact that the size of an ovarian tumour bears no relation to the real difficulties of the operation, and the rapid recovery of the poor woman, who had been relieved of so terrible an incumbrance, was gratifying in the extreme. The patient reported herself more than two years after the operation, fat and happy, and in every way in perfect health.

Of the other successful cases, there are very few circumstances worthy of note. Two of them contained over twenty pints of fluid, and all except two over ten pints; in case No. 8 the cyst contained thirty-five pints, and the woman, who was forty years of age, recovered without any rise of temperature at all. She left hospital seventeen days after operation.

Case No. 2 left hospital twenty-four days after operation, the average detention being considerably under four weeks. In all these cases the abdominal incision healed by first intention, and in only two of them, in which septic stitch abscesses formed, was there any antiseptic failure.

In every instance the pedicles were fairly long and narrow. There was no difficulty in securing any of them with the ordinary Staffordshire knot. No broad short pedicles were encountered. In three cases the adhesions were troublesome, and some patience was required to separate and ligature them.

The incisions in almost all the operations were, perhaps, unnecessarily long, but it does not appear that any harm has resulted from this circumstance.

Compared with the numbers that present themselves for operation at a special hospital, a small series of fourteen cases, extending over seven years, is petty and insignificant. But it must be borne in mind that it is with extreme reluctance that Indian women submit to any surgical treatment whatever.

The numbers compare favourably with those of other districts.

OVARIOTOMY IN BENGAL.

BY S. P. SARBADHIKARI.

I PROPOSE very briefly to place before you a summary of the ovariotomies performed in Bengal, so far as their number can be ascertained, during the last quarter of a century.

As far as is known, the first to perform this operation in Bengal was Brigade-Surgeon-Lieutenant-Colonel Kenneth McLeod. So far back as 1868, while employed as civil surgeon of Jessore, he performed an ovariotomy, which was unsuccessful. The latter fact is not surprising, seeing that the operation was still in its infancy, even in Europe, and was attended with the enormously high mortality of forty to sixty per cent. or more according to the skill and experience of the particular operator in question. The pluck and daring displayed so early were, however, quite on a par with the well-known boldness and decision which characterized all his subsequent surgical procedures. Those were days when the clamp and cautery were used to secure the pedicle and arrest hæmorrhage, while the stump was treated extra-peritoneally, being allowed to slough away in course of time. Antiseptics, too, were not known.

Between the years 1870 and 1895 Dr. Charles, who held the chair of midwifery and gynæcology in the Medical College Hospital, performed ten ovariotomies. These do not appear in the Surgeon-General's reports for Bengal, because they were performed, not in the Medical College Hospital, but in private houses, all costs being paid by the operator. It had come to be recognized that it was dangerous to perform the operation in a general hospital, and that the cases called for special accommodation and isolation to ensure them against septic infection. All these cases proved fatal, with the exception of one, which, though not immediately fatal, died two months or so after from exhaustion resulting from fever, which never left the patient from the day of operation. Most of these cases died of shock from a few hours to three days after operation—some from septicæmia, while two died of secondary hæmorrhage. Ligaturing the pedicle had been done in both these cases. The mode of treatment of the stump was still extra-peritoneal, and antiseptics had not come into use. These results naturally disappointed the operator sorely. He was often heard to say that it was the dream of his life to perform one successful ovariotomy some day. I may mention in passing that his successive failures in this connection were attributed largely to the defective hygiene of the rented houses where these cases were treated. The Medical College Hospital was considered unfit to be the scene of these operations by reason of its being a general hospital. These failures started the idea of getting a special gynæcological hospital built, although Dr. Charles did not remain long enough in India to see his favourite idea carried out, and had to leave the execution of it to his successor, Dr. Harvey. This is the origin of the magnificent hospital know as the Eden Hospital of Calcutta.

Next, in the series of early workers in ovariotomy, is Dr. Pilcher, who performed one operation successfully at the Howrah Hospital in 1878.

In 1879 Dr. Cayley had two cases at the Mayo Hospital, both being performed under the spray, thus making a new era in the history of ovariotomy. In both, the treatment of the stump was extra-peritoneal. The pedicles were ligatured and cauterized. One case was successful and the other fatal. The successful case made a tedious recovery.

In the same year (1879) there was a case at the Medical College Hospital by Dr. Harvey, this being his first case and a successful one. Antiseptics were now in full swing, and glass drains had also come into use.

In 1880 Dr. Cayley performed another operation at the Mayo Hospital, which was fatal. During the same year Dr. Harvey had three operations in the Medical College Hospital, two being fatal, the third making a recovery. Now begin the operation as we know them at the present day, being more or less the same in finish and technique, the patient beng discharged in three or four weeks, and often less, from the hospital. The Eden Hospital was completed, and was open for the reception of patients in 1883, Dr. Harvey being in charge. That year there were two operations in this hospital, both ending in death, proving that the locality where the operation was performed was at best a small factor in

List of Ovarian Operations.

No.	Date of operation.	Age.	Condition & No. of children.	Length of incisions.	Adhesions.	Ovary removed.	Amount of fluid contents and weight of sac.	Highest temperature of the operation.	Result.	Name and Race.	Duration of disease.	No. of days in hospital after operation.	REMARKS.
							CHUPRA DISPENSARY.						
1	2-12-87	45	4 children	4″	No adhesions ...	Left	11 pints, Cyst weight 2lb.	100·2	Cured	Guriani, Hindu ...	11½ years	27 days	
2	5 12-87	44	5 „	4½	Adherent anteriorly ...	Right	13 „ „ „ „	99·6	Cured	Rukminia, Hindu	8 years	16 days	Slight superficial suppuration in the track of wound which healed almost by first intention.
							MAZAFFARPUR DISPENSARY.						
1	22-10-90	50	3 children, all died	5¼″	None	Left	22 pints of glairy fluid, cyst weight 4lbs.	100·1	Cured	Kapuran, Mahomeden.	3 years	20 days	Complication--Vomiting after operation.
2	22-1-90	45	4 children	4″	Strong and extensive posterior and lateral adhesions of cyst.	Right	16 pints, cyst weight 1lb.	100·0	Cured	Salimun, do.	3 years	23 days	
3	24-2-90	42	8 „	6″	Very extensive universal adhesions.	Left	41 „ „ „ 1lb. 11oz.	„	Died	Jugput, Hindu ...	10 years	1 day	Died of shock. Lived only for two hours after operation.
4	7-6-90	43	3 „	3″	Slight parietal adhesions.	Left	21½ „ „ „ 2lbs.	100·6	Cured	Badamee, Hindu	3 years	16 days	
5	3-10-90	19	None	4½″	Very extensive and universal adhesions.	Not removed *in toto.*	48 „ „ „ nil.	„	Died	Peary, Hindu ...	2 years	1 day	Of shock after operation. Part of the cyst could not be removed without immediate risk to life.
6	17-10-91	19	Ditto	4½″	Slight adhesions at the upper part of cyst.	Right	14 „ „ „ 1lb. 7oz.	100·4	Cured	Chumpi, Hindu	5 months	36 days	Septic abscess in suture track.
7	31-10-91	49	4 children	4½″	Extensive universal adhesions.	Not removed *in toto.*	35 „ 3oz., cyst weight nil.	„	Died	Goodhni, Hindu...	10 years	1 day	Died of shock after operation. Fluid contents purulent and mixed with putrid masses.
8	10-12-91	40	6 „	4″	Parietal adhesions anteriorly and in the upper surface of cyst.	Left	35 „ 3oz. „ „ 2lb 4oz.	No rise at all.	Cured	Domhi, Hindu ...	2 years	17 days	
9	22-12-91	30	1 child	3″	None	Right	16 „ 8oz. „ „ 9¼ oz.	99·0	Cured	Punia, Hindu ...	8 years	17 days	
10	15-1-92	48	6 children	3″	None	Not noted.	9 „ 12oz. „ „ 8oz.	101·6	Died	Paro, Hindu ..	2½ years	15 days	Of diarrhœa, &c.
11	16-4-92	40	9 „	4″	Some anterior adhesions...	Right	83 „ 3oz. „ „ 2lb. 4oz.	101·0	Cured	Sherunia, Hindu...	1¼ years	25 days	
12	2-9-94	22	None	5″	None	Left	4 „ 16oz. „ „ 1 „ 10 „	102·0	Cured	Chullia, Hindu ...	2 years	20 days	

the success or failure. Rigid antiseptic precautions were observed in these days. Treatment of the stump was extra-peritoneal and drainage valves were used.

In 1884, there was one operation by Dr. Cayley at the Mayo Hospital, the case being fatal. There were three cases at the Eden Hospital, two being successful and one fatal.

In 1885, there were four cases at the Eden Hospital, two successful and two fatal.

In 1886, there were three operations at the Eden Hospital, all successful.

In 1887, there were eight cases in the same hospital, with three fatal cases.

In 1888, five operations were performed, two being fatal. Dr. Joubert took over charge of the Eden Hospital in this year.

In 1889, there were six cases, all ending in recovery, in the same hospital.

In 1890, there were eleven cases, with eight recoveries and three deaths, all in the Eden.

In 1891, there were fifteen operations, with only one fatal result, which was a case complicated by pyosalpinx and suppurating ovary ; the death is, therefore, easily explained. All the cases occurred in the Eden Hospital.

In 1892, there were four cases with one death, due to secondary hæmorrhage, attributable to rotten silk ligatures, which repeatedly gave way in tying the pedicle.

In 1893, there were seven cases performed in the Eden Hospital, all being successful, except one, which died on the table from chloroform.

In 1894, there have been nine cases at the Eden Hospital. Of these three were parovarian, of which one died, while six were ovarian. Of the latter group only one was fatal, being a case of left ovarian tumour complicated by a cyst of the right broad ligament. One of the successful ovarian cases had both ovaries affected, both being removed at the same time. One of the cases is still under treatment, and is practically all right.

This is so far as regards the great Calcutta hospital, with their specialists, where the bulk of ovarian surgery has been done as far as Bengal is concerned.

Next as regards the mofussil. The earliest and foremost among ovariotomists in the mofussil, except Dr. McLeod, whose case I have mentioned at the beginning, is Surgeon-Major Peck, at present Civil Surgeon of Muzaffurpore, who operated successfully at the Government Charitable Dispensary, Chuprah, so early as December 1887. Since then and up to date he has performed fourteen operations with four deaths and ten recoveries.

Surgeon G. Jameson has a singularly brilliant record of ovariotomies performed in mofussil dispensaries. Within the last seven years or so, he has performed seven operations without one death. Dr. Harold Brown is also known to have done a few cases.

To sum up these results : Within the last twenty-six years, for which statistics are available, there have been no less than 140 cases of ovariotomy performed in Bengal, all by the medical officers of the Government, so far as they are known. Among these there have been 101 recoveries and 39 deaths, distributed as shewn in the table given below. This takes no count of cases of laparotomy for other gynæcological purposes :—

Year.	Surgeon.	No. of operations.	Recoveries.	Deaths.	Percentage of deaths.
1868 ...	Brig.-Surg.-Lt.-Col. McLeod.	1	0	1	100 p.c.
1870-76	Dr. Charles.	10	1 (?)	9	90 „
1878 ...	Surg.-Colonel Pilcher.	1	1	0	Nil.
878-88	Surg.-Colonel Harvey.	42	32	10 [*viz.*, 4 in the first batch of 10 cases, 4 in the next batch of 15, and 2 in the next batch of 17 cases.]	23·7 p. c.
1888-94	Surg.-Lt.-Col. Joubert.	61	51	10	16·4 „
1887-94	Surg.-Major Peck.	14	10	4	28·18 „
„	Surg. Jameson	7	7	0	Nil.

A glance at the table will show the steadily increasing good results from ovariotomy of which Bengal may well be proud. As Sir Spencer Wells remarked in his address to the Calcutta Medical Society in January 1892, these results, as well as those obtained from operations on scrotal tumours, stones and cataracts, will go a long way in raising the standard of Indian surgery in the estimation of Europe. I need not detain you with the improvements in the technique of the operation which have brought about these results, as they are to be found in all text-books and books of reference.

But much as has been done in popularizing ovariotomy in Bengal, more yet remains to be done. It cannot be denied that the class of people from whom the native patients hitherto operated on have been drawn belong to the lowest ranks of the community, who have slowly come to lose their terror of, and prejudice against, a stay in hospital. The Dufferin Hospitals are doing a great deal in breaking down these prejudices and superstitions, yet more, as far as these classes are concerned. But there are also the respectable poor and the well-to-do classes to consider. A very large amount of uterine and ovarian trouble is present among the females of these classes. In the short space of two-years-and-a- half, I have seen no less than eighteen cases of ovarian and uterine tumours among the middle and the lower middle classes. And I have no doubt that each one of you must have seen a good number within the same time. These are the people, the real zenana ladies of the middle and the respectable poor classes, for whom the zenana hospitals were intended, and not the women of the lower classes, who already used to frequent hospitals before the Lady Dufferin Institutions came into existence. Yet these are the very people who will shun the Dufferin Hospitals just as much as any other public charity. This is a matter which is, and should be, well known to the authorities of these institutions For my part, I have never been able to persuade any one of my female patients, requiring any severe operative interference, to go to the Dufferin Hospital, much less to the Eden Hospital, although I strongly and repeatedly assured them of the advantages of doing so, adding that privacy is absolutely ensured, and caste prejudices fully attended to in these institutions. I have known a Hindu clerk, on Rs. 40 to 50 a month, offer to spend all the little that he possessed to get a wife, or a daughter, or a sister, suffering from uterine or ovarian tumour treated at home. Failing that, the woman elects to remain at home untreated, her friends concurring in her wish. I have no doubt that that has been the experience with many of you. The reason is not far to seek. The Bengali, and particularly the Bengali woman of the classes I have mentioned, is by instinct unable to leave home and family for a hospital in the hour of sickness and suffering. The male relations, too, partly from tender regard for the feelings of the sufferer, and partly from a peculiar sense of *izzut*,* very difficult to explain to a European, will not hear of the proposal. This is not due to any fault in the hospital management in connection with the Dufferin Institutions, for which I have nothing but admiration to express, but to causes inherent in the nature of the Bengali. I do not mean to say that no real zenana ladies attend the Dufferin or other hospitals. But I do say that their number is in a microscopic minority.

On the other hand, there is a very distinct and strong disinclination on the part of leading specialists to undertake any serious case of major peritoneal surgery in the private houses of the middle and lower middle native classes, and even of the upper classes. I understand that they strongly advise even fairly well-to-do European and Eurasian patients to come to hospital for operation. The ground for this disinclination is the fear that such operations are very apt to prove fatal, owing to unhygienic surroundings, mismanagement of the patient by the friends after the operations, the want of a medical and nursing staff to look after the patient, as she is looked after in a hospital, particularly in case of emergency ; so it happens that between the patient's disinclination to go to hospital, and the doctor's objection to take up the case at home, the patient remains at home practically unhealed till death relieves her of her sufferings. I know many cases of ovarian tumours that have remained untreated from this combination of causes with untold suffering as the result.

I have been very much struck with this state of matters. It has been my aim to direct my humble efforts to bring about, if possible, an alteration in this state of things, as far as lay in me. I confess the difficulties in the way looked enormous at the beginning, and looked yet greater in the light of the advice to desist received from those at whose feet I had learnt my profession. But a study of the cases done at out-of-the-way small mofussil charitable dispensaries encouraged me, with the result that profiting by the experience of the successes and failures of those who have long been working in this special time, I can place before you the record of seven cases of laparatomy done on females in private practice in the course of two-years-and-a-half. Four were completed cases of successful ovariotomy, one of successful abdominal hysterectomy for cancer, one oophorectomy for herniation of ovary through a foul abdominal wound, one of retrocœcal abscess, and one of obstruction of bowels. These were done in all seasons of the year in ordinary native houses, in crowded localities in the northern quarter of the town, not particularly noted for hygienic excellence, with the drains smelling any thing but sweet. Yet the results have been most encouraging. In my first case, that of abdominal hysterectomy, there was a cowshed within four yards of the sick-room. Yet in this case the patient healed her wounds aseptically in the course of three weeks [*vide* "I. M. Gazette," January 1893].

The only one of the seven cases of laparatomy that died was the one for obstruction of the bowels, in which there had been perforation of the small intestines, with escape of thin fæcal matter into the peritoneun. This death, of course, was unavoidable. I submit, therefore, that if the immediate surroundings of the patient are kept scrupulously clean, and if the operation and subsequent dressings are carried out strictly antiseptically, and the general management of the case is in accordance with modern teachings, there is every hope of obtaining good results from peritoneal surgery performed in houses which are mere slums compared with the wards of our hospitals. The general supervision and management of one such case at home, I admit, taxes the resources, the tact and patience, and the time of the medical man ten times more than the management of half-a-dozen cases in hospital at the same time. But such a tax, I submit, ought to be cheerfully submitted to under the circumstances which I have just detailed, at least by our own countrymen, who, by their intimate knowledge of the habits of their own people, should be able effectually to guide and check them as needs be.

I shall give you in a tabular form the details of the four cases of ovariotomy. In regard to the fourth case, I should mention only one matter. It was the largest of the four occurring in a very thin and emaciated woman, who was habitually dyspeptic. Yet she did better than the others, the wound healing by first intention in seven days, the stitches being removed on the eighth day, an abdominal band now taking the place of all dressings. I ceased to attend on the tenth day, further attendance being considered unnecessary. The twelfth day from the time of the operation was a day of thanksgiving and feasting. As a consequence, sweetmeats of the most indigestible character were readily procurable in plenty in the house, and the patient utilized her opportunities and had a surfeit of sweets on the sly. Purging and vomiting came on in the course of a few hours, and the patient died in eight hours, with full choleraic symptoms, the stolen sweets being a prominent feature of the first few stools and the vomit. Since the patient died from causes unconnected with the operation, I have counted it as a successful case.

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* "Izzut" is Hindustani for "self-esteem."

I shall now tabulate the four cases :—

No. and caste, etc.	Date of operation.	Age.	Length of incision.	Adhesions.	Amount of liquids and solids.	Highest temperature.	Duration of disease.	Time under treatment.
1. H. F.,* Nullipara.	March 4th, 1893.	39	5½ inches ...	Slight posteriorly, cyst multi-locular.	30 pints of fluid; weight of sac 1½lbs.	99°F.	4 years.	27 days.
2. H. F. Nullipara.	August 5th, 1893.	36	7½ " ...	Old and firm adhesions with intestine low down in the pelvis, posteriorly cyst multi-locular and dermoid.	28 pints; weight of sac 4lbs, solid in many places.	100°4' F.	3 "	23 "
3. H. F., (para. 2)	Nov. 10th, 1893.	47	4¼ " ...	None, cyst uni-locular	Liquid 20 pints; weight of sac ½lb.	99°2'F.	3½ "	19 "
4. H. F., Nullipara.	August 5th	35	5 " ...	Many, and fibrous at the sides and back, cyst multi-locular.	42 pints of liquid; weight of sac 6lbs.	98'8'F.	5 "	10 "

I shall not detain you by relating the steps of the operation, for they differed in no way from those described in books, but I beg leave to say a few words regarding some of the details :—

I. *Regarding the incision.*—In two out of my seven cases of laparatomy, the incision through the superficial tissues suppurated. Fortunately plastic lymph had previously shut off and agglutinated the peritoneum, or else the consequences might have been leakage of the pus into the peritoneum, and perhaps fatal suppurative peritonitis. To obviate such a contingency, however remote, in my later cases, I opened the peritoneum one-half inch to the left of the middle line, while the cut through the superficial tissues is in the median line. The two lines of incision are by this plan placed on different planes; so that, should the wound through the superficial abdominal tissues and the stitch-holes come to suppurate, as they are at times apt to do, particularly in very fat persons, who are of rather low vitality, especially in the hot weather, infiltration of the pus into the peritoneum is rendered very much more difficult if the two cuts are placed on different planes than would be the case if they were in the same plane. A second advantage of this plan is that there would be less chance of a ventral hernia forming, as is easy to conceive. The peritoneal scar in this place is supported by healthy muscle, whereas it is supported by another scar in the old and usual method. Hence, in the former case, the peritoneal scar is less likely to give way when the patient resumes her usual occupation. I was impressed by the necessity of adopting some such devise by the circumstance that I casually came across two cases, one in 1889 and another in 1890, of a considerable amount of ventral hernia occurring after abdominal section. The first case had undergone the operation at the Eden Hospital a year previously for some abdomial tumour, and the other had undergone laparatomy at the Medical College Hospital for obstruction of the bowels. I saw these cases at the out-door dispensary of the Mayo Hospital, where they came for complaints unconnected with the hernia. A third advantage attaches to this mode of opening the peritoneum. Should a second laparatomy come to be required from any cause, it would be easy to identify the peritoneum, which lies unaffected and smooth under the line of scar in the superficial tissues; if the previous section had been to the left of the middle line, I prefer to divide the peritoneum to the left of the middle line, because, should the incision be required to be prolonged above the navel, it will be easy to avoid the round ligament of the liver.

As regards *the length of the incisions.* My incisions appear to be larger than the books recommend. Possibly more experienced hands could have done with smaller incisions. But to those who are about to operate for the first time, or have had but few cases, the advantages of an incision, large enough to permit of a free view and room to manipulate, are inestimable, although harm may be done by a large incision.

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* ***Note.***—H. F. means Hindu Female.

II. *As regards drainage.*—At first one feels very nervous about shutting up an enormous strangulated pedicle without drainage. But once a man summons courage to dispense with drainage, he is surprised to find in how much shorter time the case will be fit to be discharged, thanks to the antiseptic and absorptive powers of the peritoneum. My first three cases were all drained with Keith's glass drains. They all took twice as much time, more or less, as my fourth case, which was not drained, though the pedicle in this case was very much thicker than in the others. But care should be taken to see that the pedicle is quite dry and free from oozing, while the anterior and posterior culs should also be thoroughly dried before stitching up the wounds.

III. In the toilet of the peritoneum, I use small soft hand towels, which have been previously subjected to prolonged boiling and soakage in carbolic lotion. These come very much handier, and are less likely to be left in by mistake than sponges, being very much bigger. With this view I select towels with coloured stripes on them, so as to be unmistakable even when stuffed in between or over coils of intestines. This is a small matter and possibly one of individual taste. In this connection I beg leave to point out that flushing out the peritoneal cavity with carbolised lotion is unadvisable; for carbolic acid has a distinct power of damaging the absorptive power of the endothelium.

Before concluding this paper, I may say that my friend, Dr. Nil Ratan Sircar, has recently performed two ovariotomies, one being successful and one fatal. I entreat my countrymen whose tastes incline them this way to think seriously of the number of native women, who, under the present circumstances, are more or less debarred from receiving the benefit of European surgery, and to do what they can in relieving these cases. One of my objects in bringing the paper before you is to shew that ovariotomy can be performed in private houses of natives with just as much hope of success as in well-appointed special hospitals.

DISCUSSION.

Fink (*Bijnor*) referred to a series of five cases of ovariotomy on which he had operated at the Lady Dufferin Hospital at Bijnor. The first case which had to be treated by prolonged drainage died on the fiftieth day after operation from intercurrent dysentery. The second case was discharged cured on the nineteenth day. The next three cases were more tedious, being discharged about the fortieth day. He used perchloride of mercury solution (1 in 10,000) for the peritoneal toilette, and was particularly careful to stop all oozing before closing the wound. For sutures he used silver wire placed at intervals of an inch, the sutures taking up all tissues from skin to peritoneum. Superficial horse-hair sutures were placed between the silver one. To him it seemed an especial point not to tie the sutures too tightly. He thought that lateral pads of cotton wool should be placed on each side of the wound to take off the pressure of the bandage.

Dr. Joubert regretted that he had been unable to be present at the reading of Dr. Surbadhicary's and Dr. Peck's papers, but he wished to congratulate these gentlemen on their favourable results. Having at his own disposal all the resources of a large Metropolitan hospital, he fully realised the difficulties these gentlemen had to contend with in their own operations in native houses or at Mofussil dispensaries: all the more credit to them.

With regard to Dr. Fink's remarks about the special precautions he took to avoid pressure on the abdominal wound, Dr. Joubert thought these precautions were unnecessary, as the lateral pressure exercised by the bandage round the body caused the central incision to sink in, and so obviate all pressure on it. Further if silk worm gut sutures were used suppuration at the stitch holes would rarely, if ever, occur. He had only had about two or three cases of such suppuration in about 150 abdominal sections which he had performed, and in all these the accident was due to the wound becoming exposed on account of restlessness on the part of the patient.

With regard to drainage, he found in common with other operation that the oftener he operated the less frequently he decided that drainage was necessary.

Peck (*Mozufferpur*), in replying, said that he did not quite see the necessity of incising the peritoneum on one side of the median incision as a safeguard against the formation of a ventral hernia after. He had not met with a ventral hernia in his own cases. He thought that the occurrence of ventral hernia depended, to a considerable extent, on the case with which the wound was sutured. To him the length of incision did not seem of such paramount importance. Great care was necessary in the application of ligatures.

THE SUPPOSED INFLUENCE OF TROPICAL CLIMATE ON MENSTRUATION.

BY C. H. JOUBERT, M.B., F.R.C.S.,
Surgeon-Lieutenant-Colonel, I. M. S.

THERE always seems to have been an impression in the mind of the medical profession that residence in tropical climates causes menstruation to appear at an earlier age than in temperate climates. Most text books merely repeat the statement without comment. Playfair, however, in the 7th edition of his Science and Practice of Midwifery, says that the influence of climate has been unduly exaggerated, and it is my object in this short paper to bring forward some facts in support of this statement.

In collecting information on the subject we are met at once by the difficulty that we have to rely upon the statements of women themselves as to the date, or age rather, at which they commenced to menstruate, and their statements are merely founded upon memory. The age fixed, therefore, must always be approximate only, not absolutely correct. But when we take the statements of large number, we may fairly assume that we get somewhere near the truth.

Some years ago, I commenced recording at the Eden Hospital for Women, Calcutta, the personal statement of every woman admitted as to the age at which she commenced to menstruate. During the same period I also made notes of the same fact in a good many cases of patients in my private practice. The period covered by these observations is for about four years up to the middle of 1894. Some of my records were made use of by my friend and pupil, Dr. Kedar Nath Dass, for some statistics supplied by him, which have appeared in Davidson's Hygiene and Diseases of Warm Climates. In my table the Europeans are all from my private patients who, I personally ascertained, passed their youth and adolescence in Europe. The Europeans, country-born, are chiefly hospital cases, amongst whom may be a few Europe-born persons, but not sufficient to affect the percentage materially. In collecting the numbers from the hospital records doubtful cases were excluded.

On examining the table at the end of this paper, it will be at once noticed that there is very little difference in the percentages for the various ages between the Europeans and the country-born Europeans, who have lived all their lives under the influence of a tropical climate, so little difference that the question at once arises as to whether there has been any influence at all.

In the next class, that of Eurasians, a difference is at once noticeable, the type approaching that of natives between the ages of 12 to 14 years, but diverging again in the direction of the European type between the ages of 14 to 16 years.

In the class of pure natives, Hindoos and Mahomedans, but chiefly the former, the greatest percentage of dates of first menstruation occurs between the 12th and 14th year, amounting to 65·7 of the whole class.

The number of Jewesses observed is small, but it will be observed that the menstrual type resembles that of the European and country-born European.

If the figures in my table be allowed to be approximately correct, the only conclusion we can come to is that residence in a tropical climate during youth and adolescence has not the marked effect in causing early menstruation which was formerly attributed to it, and we must seek for some other cause influencing the native races of India and to a lesser degree the Eurasian of mixed native and European parentage.

Failing the influence of climate, we may enquire into the social customs of the different races, and here I think we touch the true cause of precocious menstruation. European women are rarely married before their 18th year, and more often much later. It is the earnest endeavour also of all European parents to keep their children ignorant on the subject of sexual matters till they are grown up. Many English women marry in perfect ignorance of what marriage means and with only a very hazy idea on the subject of child-bearing. We need not discuss whether this is right or wrong, but it certainly is very wise and proper that children should be kept ignorant of the facts of sexual relations. There can be no question whatever as to the difference in the amount of knowledge upon this point possessed between the majority of European children and all Oriental children.

Now, what are the social customs of the races of India which constitute this difference? First and foremost I would place the absolute want of privacy in the inner mode of life of an Indian native household. There is of course very rigid seclusion of the female inmates and children from the outer world in general, but there is what I may term an absolute want of domestic privacy. I have for many years past seen a good deal of the inner life of native houses during professional visits. What has always struck me very forcibly is the utter want of restraint with which the ailments and most private concerns of women sick, suffering from female complaints or the conditions peculiar to child-birth and pregnancy, are discussed by the whole family in the presence of children who are just old enough to understand the subject of conversation. Indeed times without number when I have had to examine a pregnant or lying-in-woman I have had to ask for the children and youths of both sexes, who crowd in to see what is going on, to be sent away. Never once have I found that it has struck any grown-up member of the household that the presence of the children was improper, and that they would see and hear things that they had better not know. Indeed, I have often been told that it is unkind of me to want the children to be sent away and their natural curiosity restrained. In the large joint families so common out here, child-birth in the house is of common occurrence, and I do not think I am going too far when I say that I doubt if there are any little boys or girls in native houses in this country who have reached the age of ten years who do not have a very fair knowledge of what the sexual relations and child-bearing really mean. I hope my Indian friends will not misunderstand me. I am merely stating what I believe to be a fact from what I have observed of their domestic habits.

Now, what can be the result of all this, but undue sexual precocity as regards knowledge. But this might not be sufficient to account for precocious menstruation, so we may go further and inquire into what effect the marriage customs in this country have.

A Hindu friend and *confrére* of mine has supplied me with some interesting notes on Hindu marriage customs. The Hindu shastras (religious laws) order that a girl shall be married before she has passed her tenth year, the non-observance of the law being a sin. If however a suitable husband cannot be obtained the shastras permit the postponement of the marriage of the girl till one can be found. The Kulin Brahmans in Bengal take advantage of this permission, as suitable husbands for their girls are not easy to find, and they often postpone the marriage of their girls till quite late. Want of means to meet the heavy marriage expenses often in other castes causes postponement of the ceremony, and also the fear of the child being left a widow at an early age. But in any case, except the Kulins, it is rarely postponed beyond the 12th year. As regards the details of the marriage, I am informed that the following are the usual customs: after the religious ceremony performed after sunset, the bridegroom and his child-bride are ritually tied together by knotting a corner of his scarf to a corner of her *sari*, and they are conducted to a room where they pass the night in company with the women of the household and other female relatives and friends. The next day the bride is carried to her father-in-law's house, and on the second night the husband and wife are not allowed to see each other. The third night however is the night of the "phulsujya" or flower bed," and the young pair are allowed to sleep together, but still, however, under the eye of the women of the household, and this goes on till the eighth night. Since the passing of the Age of Consent Act however the third night is often the only one spent theoretically alone. It is not difficult to imagine the amount of sexual excitement produced in the girl by these customs, even if actual congress does not take place.

On the ninth day the bride is taken back to her father's house to remain there till the second or third year after marriage, when she is finally sent to her father-in-law's house to perform the duties of a wife and daughter in her new home. During this period menstruation has commonly commenced, and the girl may have reached her 13th or 14th year. The commencement of menstruation is usually made the occasion of a festival in the family. It is considered a sin for intercourse to take place before the appearance of menstruation, but it is a matter of fact that during the two or three years that the girl passes in her own father's house after marriage the husband is allowed to pay frequent visits to his wife and to pass the night with her. It appears, however, that frequently the bride is sent to the husband's house after the eighth day, there to remain permanently.

Now, is it surprising, with all this amount of sexual excitement, combined with knowledge, that the result is the early appearance of the menses, when you compare with this the different life between the ages of 10 and 13 years of European and many Eurasian children? Then certainly the Europeans are hard at work with their lessons or their innocent games, and nothing is more remote from their lives and knowledge than the relations of the sexes, whereas the native female child lives in an atmosphere of sexual excitement, and apparently often is exposed to the possibility of sexual intercourse – authorised perhaps by native customs, but illegal according to the present laws, and improper certainly from a moral point of view.

Native Christians and other natives belonging to the Brahmo Somaj marry their girls late. I have not been able to procure any statistics as to the former, but Dr. Bholya Chundra Sen in his paper on the pubile age of female in India published the facts connected with 65 members of the Brahmo community. Of these 44·6 per cent. menstruated for the first time between 13 and 14, and 40·0 per cent. between 14 and 15 years of age.

With reference to the effect of sexual intercourse previous to menstruation, Dr. Jogendra Nath Ghose has given me the facts relating to 40 such cases. In these cases the first menses appeared in the 10th year in 2 cases; in the 11th year in more than half; in the 12th year in rather less than half; in the 13th year in one case only.

We have still to consider the facts as regards Eurasians noted in my table. It will be noticed that for the ages of 12 to 13, 13 to 14 and 14 to 15 the percentages are 22·0, 31·8 and 22·0, respectively, occupying an intermediate position between the pure Europeans and the pure natives. The figures apply chiefly to hospital cases, Eurasians of the poorer classes living in Calcutta. Their habits are more those of natives than of Europeans, and they live in large families with the same complete absence of domestic privacy. Their children are of necessity early acquainted with the facts of sexual life. Early marriage is very common among them, though probably rarely before the first menstruation.

If the records at the Eden Hospital are kept up for a number of years on the lines I have inaugurated, I think that in time a sufficiently large number of facts will be recorded to put this question at rest.

The conclusion I have come to is that it is not the residence in a tropical climate which determines early menstruation but precocious knowledge and too early sexual excitement.

Ages of first Menstruation.

RACE.	10—11 years.		11—12 years.		12—13 years.		13—14 years.		14—15 years.		15—16 years.		16—17 years.		17—18 years.		18—19 years.		Total.
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.	
Europeans ...	5	2·7	11	6 1	24	13·4	42	23·4	38	21 2	30	16·7	15	8·3	11	6·1	3	1·6	179
European, Country Born	3	0·7	14	3·6	42	10·8	100	25·8	96	24 8	67	17·3	48	12·4	12	3·1	5	1·2	387
Eurasians ...	6	0·7	50	6 2	175	22·0	253	31 8	175	22 0	84	10·5	34	4·2	14	1·7	5	0·6	795
Natives ...	35	2·0	184	10 4	648	36·4	515	29·3	244	13·9	80	4·5	40	2·2	5	0 2	1	0 04	1,752
Jewesses ...	...	...	2	2·7	7	9 5	25	34·2	24	34 2	13	17 8	1	1·3	1	1·3	...	...	73
Chinese ...	...	...	...	...	1	12·5	5	62·5	1	12·5	...	...	1	12·5	...	...	...	...	8
Total cases ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3,194

MENSTRUATION IN WARM CLIMATES.

BY BALLY CHUNDER SEN.

In opening the subject I have taken up, I cannot do better than place before you the five tables I have collected for its elucidation. By this method alone can we hope to arrive at an approximate, if not a positive, certainly, though we may not be disposed to place implicit reliance on those statistics, still they serve to point unmistakably to only one conclusion.

The first table I have taken is from Copland's "Dictionary of Practical Medicine," which, though now considered obsolete, cannot be said to be obsolete as regards facts. The second and third have been taken from Davidson's recent work on "Hygiene and Diseases of Warm Climates." The fourth is collected by myself, and the fifth is from the British Medical Journal of 30th June 1894, page 103, article 517.

From these several tabular statements, I will draw certain inferences and conclusions, and leave them entirely to the Congress to decide whether we are warranted in ascribing wholly or even partially to climate what may be justly considered due to other causes:—

TABLE I.

Taken from Copland's "Dictionary of Practical Medicine."

Years.	Reported by Mr. Petriquin.	At Marseilles and Toulon.	By Bouchacouf at Lyons.	At Lyons.	At Paris.	At Manchester.	At Goetengen.	Total.
9	...	...	...	...	1	...	...	1
10	4	...	1	5	...	...	...	10
11	10	6	4	14	3	10	...	47
12	15	10	11	26	14	19	3	98
13	33	13	14	47	6	53	8	174
14	33	9	17	50	18	85	21	233
15	45	16	31	76	54	97	32	351
16	48	8	31	79	7	76	24	273
17	32	4	26	58	6	57	11	194
18	27	2	11	38	5	26	18	127
19	12	...	9	21	8	27	10	87
20	8	...	2	9	3	4	8	34
21	4	...	...	5	...	...	...	9
22	1	...	1	1	...	...	2	5
23	...	...	...	...	...	...	...	...
24	...	3	2	...	...	...	...	5

TABLE II.

From Davidson's work on "Hygiene and Diseases of Warm Climates."

Class.	Observer.	Ages.									Total.
		10	11	12	13	14	15	16	17	18	
English girls in England.	Madden ...	...	...	17	50	94	138	105	65	10	479
English girls under Indian climatic influences.	K. N. Das...	1	8	15	21	35	15	15	5	1	116
Ditto ...	Fayrer ...	...	...	4	8	9	5	1	...	...	27
Eurasians and East Indians.	K. N. Das...	2	23	78	117	112	62	17	4	3	418

TABLE III.

From Davidson's work on "Hygiene and Diseases of Warm Climates."

Class.	Ages.											Total.
	9	10	11	12	13	14	15	16	17	18	19	
Natives of India, Hindus and Mahomedans.	10	74	296	271	144	56	34	3	2	1	2	893
High-class Indian girls.	...	...	10	8	2	...	...	...	...	...	...	20
Eastern Jewesses	...	...	1	2	8	14	5	2	...	...	...	38

TABLE IV.

Collected by the writer himself.

Class.	Below 12 years.	12	13	14	15	16	Above 16 years	Total.
Brahmo girls	2	3	29	26	4	1	...	65
Native Christian girls	2	6	21	24	11	...	...	64
Eurasian girls	3	4	6	3	1	...	...	17

TABLE V.

Taken from the British Medical Journal, page 103, article 517, dated 30th June 1894.

(Puberty in Cold Countries.)

Grusdeff (Centralblat of Gynak, No. 23, 1894) has collected statistics of 10,000 women, all inhabitants of European Russia. The averages only are given:—

German women	15·14
Poles	15·33
Jewesses	15·40
True Russians	15·75
Esthonians and Lapps ... ... Fino-Sclavonic races	16·19
True Fins	16·27

The foregoing tables show: *firstly*, that girls of the same race and in different climates menstruate at different ages; *secondly*, that girls of different races under the same climatic influence menstrute at different ages; and, *thirdly*, that girls of the same race and in the same climate menstruate at different ages.

The above seems highly incongruous and wholly irreconcileable, but facts and figures are stubborn things and cannot be gainsaid. I have pondered a great deal on the subject for a number of years, and have come to the conclusion, rightly or wrongly, that climate or race has scarcely any appreciable influence in hastening or retarding the menstrual function in girls, but their environment has.

I will first take up the first point that girls of the same race in different climates menstruate at different ages.

On referring to Tables I, II, III and V, we find that European girls in Europe menstruate in the largest number at 15 years, the next at 16, and a still smaller number at 14 years; while in Calcutta the largest number of European girls menstruate at 14 years, the next at 13, and a still lesser number at 15 years. In the case of Jewish girls, we see that in Russia their average age of menstruation is 15·40 years, while in Calcutta they menstruate in the largest number at 14 years, next at 13, and still smaller number at 15 years.

This clearly goes to establish that some influence, whatever it might be, is at work to hasten this function at least one year earlier in Calcutta than in Europe.

I have advisedly put in Calcutta, instead of India, because the statistics were collected at the Eden Hospital by Dr K. N. Das and by Sir Joseph Fayrer from a girl's school in Calcutta.

Now it is an ascertained fact that the functions of the body in warm climates are carried on languidly, the pulse is slow, the respiration is slow, and hence, as perfect oxygenation of the blood does not take place as in colder latitudes, appetite is dull and digestion is slow and imperfect, hence proper growth and development of the body cannot be expected to take place.

When we see that all the other physiological functions of the body are thus sluggish in warm climates, why should menstruation be the only function that makes its appearance earlier? Climate, however, it is well known, does not materially affect the temperature of the body.

Dr. Carpenter in a foot-note in his "Physiology," speaking of menstruation, says:—

> "The fact seems to be, that this, like other *periodic*, phenomena of warm-blooded animals, is but little influenced by external temperature, simply because the rate of growth and development, of which these phenomena are the exponents, is determined by the temperature of the body itself, not by that of the surrounding medium."

According to the statements made above, which have been taken from the chapter on "The Influence of Warm Climates on the Constitution" in Davidson's work, and the opinion of one of the greatest physiologists, this should not be so. May we then not unreasonably come to the conclusion that it is not climate that affects and causes this disparity in the age of the first menses.

The second point arising from the tables is that girls of different races under the same climatic influence menstruate at different ages.

On looking at the Tables II, III and V, we find it stated that the native Indian girls (Hindus and Mahomedans) menstruate in the largest number at 11 years, the next at 12, and a still smaller number at 13 years. The Eurasians come next (this tallies with the figures in Table IV, collected by the writer himself), the Jewesses third and the European girls head the list as regards the higher age in which this function first commences. So we see there is a difference of about two years between the native Indian girl and the European girl under Indian climatic influence. In Table V, we find a difference of 1·13 years between the true Fin and German women, and it is a noteworthy fact that Jewish woman, originally a native of warm climate, menstruates later than Polish or the German woman in European countries.

Here the influence of climate is not at all perceived, but the racial one seems to predominate and determines the period. Why should it be so? Is it due to greater animal heat in the one class than in the other? Actual careful observations point the other way. Dr. Birch in Davidson's work, referring to Dr. A. Crombie's observations on the subject of body heat of Indians and Europeans in India, says:—

> "That observer found that the mean diurnal difference of temperature in the axilla, mouth, and rectum are practically the same in Europeans and Indians, and that they are in close accordance with English results."

So it is not extra heat in one race over that of another. Then why should the Jewess in Calcutta menstruate a year-and-a-half earlier than her sister in Russia? when it has been previously shown that climate does not influence the early or late development of this function.

We may conclude that the theory of race like that of climate falls to the ground.

Lastly, we come to our last point, *viz.*, that the girls of the same race and under the same climatic influence menstruate at different ages.

This will be apparent on a reference to Tables III and IV. In Table III it will be seen that the Indian girls (Hindus and Mahomedans) menstruate in largest number between the ages of 11 and 13, while the Brahmo and Native Christian girls do the same between the ages of 13 and 14. So it will be seen that the latter commence to menstruate a year-and-a-half later than their sisters of the Hindu and Mahomedan faiths, and in this respect they are on a level with the Eurasians and East Indians (a mixed race) and with the Eastern Jewesses, in Table II. The fact is astounding and deserves careful consideration. To my mind this disparity is due entirely to social surroundings of the girls in question. Infant marriage, amongst the Hindus, and partially among the Mahomedans, is the rule, while the Brahmos and the Native Christians have bidden adieu to that pernicious custom with the renouncement of their ancestral faith.

The Eurasian, Jewish, Brahmo, and Native Christian girls would have fared as their European sisters, had they not been like a drop in the ocean amongst the vast Hindu and Mahomedan population of this country, and if they could isolate themselves from their neighbours and their traditions to the extent the European girls do. Besides, great constitutional changes in a people cannot be expected in a generation or two for centuries are but minutes in the age of a nation.

Early menstruation of girls was not unknown in Europe, when infant marriage was in vogue there, and it was no uncommon sight to see girls of 10 or 12 years of age becoming mothers. To support this assertion by facts and figures at this distance of time is no easy task, but I will adduce a few authorities in corroboration of my statement.

In Dr. Chevers' "Medical Jurisprudence for India" we find the following:—

> "It is mentioned in Abaldinis' description of England in 1551, given in Raumer's history of the sixteenth and seventeenth centuries, that the people in general are tall of stature, the nobles in great part little, which comes from the prevalent custom of marrying rich damsels under age."

He states in another place:—

> "It is interesting to contrast this with the observation of another stranger made in 1835. The Paysans of France and the Contadini of Italy are physically far superior to their degenerate masters; while the nobility and gentry of England differ from the peasantry, in limb and feature, as the races differs from the dray horse or the greyhound from the cur."
>
> "The delicacy of Henry the Seventh's constitution has been attributed to the (alleged) fact that his mother, Lady Margaret Beaufort, was married when only nine years old, and that she was only ten when Henry was born."

In Abbott's life of Napoleon Bonaparte, it is stated that the Empress Josephine was married to her first husband "when almost a child."

Even in modern Europe, where happier marriage laws and customs prevail, it is not unusual for girls to menstruate before the usual time, owing to their surroundings. In support of this assertion I can quote such authorities as Playfair, Carpenter and Copland.

From the above facts, and from our intimate knowledge of our own society and that of all Eastern nations, it is no wonder that menstruation commences much earlier in our girls than in those that are differently situated, and these also show a precocity in this respect when placed in circumstances similar to our own as have been abundantly proved.

Thus, gentlemen, I have made an humble effort to illustrate my view of the matter and leave to you entirely to decide whether that view is correct or otherwise.

DISCUSSION.

Leahy (Alipore) thanked Surgeon-Lieutenant-Colonel Joubert for his instructive paper upon the effects of climate on menstruation. Dr. Leahy, while he felt that the subject was a most difficult one upon which to express a decided and dogmatic opinion, thought that the statistics regarding the influence of climate upon the menstruation of European women in India were too meagre to enable us to draw correct conclusions. On the other hand, the statistics regarding the menstruation of Indian women were much more plentiful, and therefore of greater value. He was unable to agree with Dr. Joubert in regarding early sexual excitement as *the* cause of the earlier appearance of menstruation among native females, and was more inclined to think that the earlier commencement of the fruitful period in the case of the Indian women, is due to the fact that she is, so to say, an oriental product, living and dying in a tropical climate. Most living things reach maturity earlier within the tropics under the influence of warmth and moisture than is the case in more temperate climates. We know that hothouse hastens the maturity of plants, and in the same way the speaker said he thought a tropical climate forced on the commencement of menstrual life in the Indian women, and also brought it to an earlier ending. Dr. Leahy further said that in his experience it was not uncommon to find that residence within the tropics on the part of the European women, while it did not cause precarious menstruation (the majority of European females having already attained sexual perfection prior to arrival in the country), still such residence did cause excessive menstrual flow without there being any organic lesion to which it could be attributed. Further, he believed in many cases of this description, the menstrual life period was shortened, though he was quite aware that many authorities differed with him on this point.

K. G. Sircar (Calcutta) remarked, with reference to Dr. Sen's statistics drawn from Brahmo Somaj girls and Native Christians, that the origin of these classes was too recent for any trustworthy inferences to be made.

D. Basu (Chota Nagpore) spoke of the result of his observations when medical inspector of emigrants in Chota Nagpur. The lower orders there lived in joint families, and there was absolutely no privacy in domestic life. The period of onset of puberty was at the fifteenth or sixteenth year, thus showing that early precocious sexual knowledge did not of itself excite early menstruation. At the same time the retarding effect of poverty and hard life had to be remembered.

A. Mitra (Kashmir) did not agree with Dr. Sen that climate had hardly any influence on menstruation. Bach showed that in 12 per cent of Anglo-Indian girls, menstruation occurred at a comparatively early age. All physiological processes began early in the tropics, *e. g.*, dentition. The span of life of a Bengali was short. During the time when the Age of Consent Bill was being discovered, he had paid considerable attention to the subject, as far as relates to Kashmir. Girls in Kashmir, with a climate like the South of France, are married in the majority of cases earlier than in India. He had elicited from young boys that connection had occurred in a large number of cases. In spite of this the average menstrual age in Kashmir is from 14 to 15. He thought, therefore, that the influence of climate on menstruation could not be ignored ; though, no doubt, there were other influences as race, heredity, environment, mode of life, too early acquirement of sexual knowledge. He instanced the experience of a friend who had observed that among the poorer classes of Hindus and Mahomedans menstruation began late, while among the higher classes, living luxuriously, it began early, even before marriage.

Kedar Nath Dass (Calcutta) said that the question whether climate has any influence of the advent of menstruation was very difficult, and could only be solved on consideration of the following facts : It was known that the process was influenced by race, environments and climate, and to estimate how much one of these factors contributed towards hastening or retarding the process, it was necessary to eliminate the influence of the other two. To estimate the influence of climate, a race under certain environments, in a certain latitude, must be taken and compared with the same, under similar environments, when exposed to the *full* climatic influence of another latitude. He said *full*, because it was far from coming at a true conclusion to take an English girl, and transplant her to a warm climate at the age of, say, 8 or 10. It was necessary to take a girl of English parentage, *born and bred* in a warm climate, to correctly estimate the influence of climate. The statistics in Davidson's "Hygiene and Diseases of Warm Climates," show that the English girl, born and bred in Calcutta, menstruates a year earlier than her sister on English soil. The following facts stated by Currier about the age of first menstruation amongst the American Indian women clearly proved that climate has great influence on this process. His statistics showed that, while the average age at which the girls living in northern latitudes, menstruated, was 17, that of the same race under similar environments, but living in the tropics, was $12\frac{13}{15}$. Dr. A. Mitra, from his experience at Kashmir, bore out the fact that climate has great influence on this process. Certainly, the fact that climate *per se* has *some* influence could not be ignored, though not to the extent generally believed. He illustrated his views in the following way, taking any age, say, 9, as the standard age to start with, and adding to it the various influences.

		Standard (same in all.)	+	Influence of race.	+	Influence of environments.	+	Influence of climate.	=	Age of first menstruation.
English (in England)	...	9	+	2	+	2	+	2	=	15
English (in a warm climate)	...	9	+	2	+	2	+	1	=	14
Bengali	...	9	+	1	+	1	+	1	=	12

Dr. Joubert, in reply, said he wished to know what authority Dr. Leahy had in stating that menstruation ceased earlier in Indian women than in European. As far as he was aware no statistics had ever been collected.

With reference to Dr. Mitra's statement that in Kashmir, where marriage and sexual intercourse took place at and continued from the age of ten years, while menstruation rarely commenced before fourteen or fifteen years ; such a fact, if it were proved by reliable statistics, would upset his (Dr. Joubert's) theory of the cause of precocious menstruation ; but he could not believe, unless accurate statistics could be presented by Dr. Mitra, that sexual intercourse could go on for four or five years without hastening the appearance of the menstrual function. Dr. Joubert understood Dr. Mitra to say that the sexual life in native females ceased about the age of twenty.

He knew there was a Bengali proverb which said "*koori, buri*" (at twenty an old women), but he had repeatedly seen native women at the Eden Hospital giving birth to their first child at between 35 and 45 years of age.

Bally Chunder Sen (Calcutta), in reply, said that menstruation does not cease early as stated by Dr. Leahy. Profuse menstruation in a warm climate was not a physiological function, but a pathological condition. He did not agree with Dr. Mitra that sexual knowledge and early intercourse had apparently little effect in determining menstruation. Such a statement required statistics to support it. The statistics given by himself in his paper of Bramho Somaj and Native Christian girls were carefully made and as trustworthy as statistics could be.

Dimmock (Bombay) remarked that the influence of heredity had not been touched on. Heredity would have distinct influence on growth and development in every locality. The continued stimulus of a hot climate on the nervous system acting through generations must have a marked result in its influence in exerting the functions of the ovaries.

PUERPERAL ECLAMPSIA.

BY KEDAR NATH DASS, M.B.

DURING the past three-years-and-a-half I have met with twenty cases of puerperal eclampsia. Of these, fourteen were seen in the course of hospital practice between March 1891 and March 1892, during which time it was my good fortune to be resident Goodeve Scholar at the Eden Hospital, Calcutta. The remaining six cases I have met with since then in the course of private practice. On going into the literature of the subject, I was greatly impressed with the greater prevalence of this disease, together with the large percentage of mortality in this city as compared with the statistics obtained in Europe and America.

These considerations have led me to the belief that the collection of as large a number of cases as possible would materially assist in the study of the various phases of puerperal eclampsia. With this object in view, I have collected all the cases of this disease that are to be found in the records of the midwifery wards of the Medical College and Eden Hospitals, Calcutta. For the free access to these records, I am much indebted to the kindness of Surgeon-Lieutenant-Colonel Joubert, professor of obstetrics and gynæcology at the Calcutta Medical College. I have purposely omitted any reference to my own private cases, and the opinions, expressed in this paper, are based entirely on the cases obtained from the hospital records, which are available from 1848. There have been altogether 101 cases of eclampsia up to the end of August 1894.

I will confine myself to facts which, if thoroughly discussed, would, I think, throw some light on the literature of the subject.

For convenience of description I have tabulated the cases under different headings, so that they can be discussed *seriatim*.

Frequency.—With regard to the proportion of women affected, to the entire number of deliveries, statistics vary. The records at my disposal give the following results: From 1848 to 1894 (August) there have been 10,728 deliveries with 101 cases of eclampsia, or one case of eclampsia to 106 deliveries.

The following table will show the frequency of occurrence as compared with the statistics of those authors to whom I have been able to refer :—

Guy's Hospital Charity	1 in 842
New York City	1 in 700
Korman	1 in 600
Braun	1 in 545
Hecker	1 in 522
Weiger	1 in 519
Klignwals	1 in 500
Krassing	1 in 500
Spiegelberg	1 in 500
Lusk	1 in 500
Galabin	1 in 500
Winckel	1 in 400
Leishman	1 in 350
Philadelphia Board of Health	1 in 333
Lohlein (Vienna Hospital)	1 in 318
Vienna General Hospital	1 in 305
Corson	1 in 300
Medical College and Eden Hospitals	1 in 106

From the above table it will be seen that eclampsia occurs much more frequently here. The question which naturally suggests itself is, why is this so? By a reference to the table of cases, appended at the end, it will be seen that out of 101 cases 15 occurred amongst Europeans and Eurasians (including Jews and Armenians), and the remainder 86 amongst natives (Hindus, Mahomedans and Christians). Supposing that Europeans and Eurasians constitute at least 40 per cent. of the total number of admissions (this I have ascertained by taking the lowest average of the last six years) we have the following ratio :—

	Deliveries.	Eclampsia cases.	Ratio.
Europeans and Eurasians ...	4,291	... 15	... 1 in 286
Natives ...	6,437	... 86	... 1 in 75

This brings out very prominently the fact that the frequency amongst *Europeans and Eurasians* very nearly approaches the lowest figure in the above table, *viz.*, 1 in 300; while the ratio amongst *natives* is very high indeed! It might be said that in hospital, only worst cases come in, thus raising the ratio. To this I may answer, that of the native population only the lowest class seeks aid in hospitals and they would come under all circumstances. Even admitting that a greater proportion of worse cases are admitted, there will still be a high ratio requiring explanation. This will be referred to again when speaking of atmospheric influences.

Frequency in primiparæ.—Eclampsia is much more frequent in primiparæ than in multiparæ. Of the 101 cases, 84 were in primiparæ. This gives a percentage of 83. The statistics given by different authors are as follows :—

	Total number of eclampsia cases.	Number of primiparæ.	Percen tage
Schauta ...	...	...	82·6
Lying-in Hospital, Dublin	36	23	67 6
,, (from 1847 to 54)	63	44	
Hecker ...	33	28	84·8
Lohlein ...	103	88	85·4
Winckel ...	683	426	77
Hall Davis ...	32	15	468
Collins ...	30	29	96·6
Clarke ..	19	16	84·2
Merriman ...	48	36	75
Lever ...	14	8	57·1
Chailly ...	13	9	69·2
Johns ...	21	19	90·4
Krassing ...	16	10	62·5
Casati ...	7	6	85·7
Guy's Charity ...	...	...	60
Medical College and Eden Hospitals ...	101	84	83

Of the 17 multiparæ, 8 were pregnant for the second time (five of whom had not gone on to full term, when convulsions came on), three in their third pregnancy, one in her fourth, two in their fifth, two in their thirteenth (one with a 11½lbs. child + 2lbs. placenta) and one in her fifteenth pregnancy.

Ætiology.—The special frequency of eclampsia in primiparæ requires explanation; but before attempting to do this, I might briefly state the different views that have been put forward, from time to time, with regard to the ætiology of eclampsia.

The toxæmic origin of eclampsia is generally admitted, since, in 1842, Lever first pointed out the close connection between albuminuria and eclampsia. Without discussing the nature of this toxic element—be it urea, carbonate of ammonia, extractives, ptomains, or what it may—this much may be admitted that *in consequence of renal failure or an inadequate secretory activity of the kidneys,* SOME *toxic element circulates in the blood, and by this poisoned blood the brain and nerve centres are brought into an irritable condition, which, reaching a certain degree, an explosion in the form of convulsions occurs.*

The question which now suggests itself is, why renal disease occurs in pregnancy?

(1) *Pressure Theory.*—Lever expressed himself as decidedly of opinion that the pressure of the gravid uterus upon the renal vessels was the cause of the albuminuria. That mechanical pressure is, at least, the cause of the temporary albuminuria, in the great majority of cases, is borne out by the fact of—(1) the special frequency of eclampsia in primiparæ, and of (2) the disappearance of the albumen from the urine soon after the uterus is evacuated of its contents.

The question, *why is eclampsia more frequent in primiparæ?* may now be considered. This has been explained by the unyielding nature of their abdominal walls, especially of the strong, healthy, plethoric, young women, who are more liable to it. The unyielding nature of the abdominal walls is certainly calculated to increase the pressure of the uterus upon the blood-vessels and nerves behind the organ, and the greater intra-abdominal pressure interferes with the renal circulation. It has been urged by Professor Carl Bartels that "the position of the renal veins protects them under all circumstances from any *direct* pressure on the part of the pregnant uterus." "The uterus," he says, "would have to be bent backwards on itself at a considerable angle, just above the inlet to the true pelvis, in order to be able to touch with its posterior wall any part of the anterior surface of the second lumbar vertebra. Even if it should reach this position, it might, it is true, compress the left but could never affect the right renal vein." This condition was noticed by him in two autopsies.

But I would suggest—(1) that the relative relation of the abdominal viscera to one another will at once change, as the peritoneal cavity is opened, owing to alteration of intra-abdominal pressure; (2) that the coils of intestines which lie in the wedge-shaped space between the posterior part of the uterus and the posterior abdominal wall, might indirectly exert pressure on the renal veins, sufficient to produce congestion. Might not the unyielding abdominal wall prevent the uterus from falling forward, away from the spinal column?

Another fact, which I have noticed in the few *post-mortems* on eclamptic cases, seems to me to be worthy of note, and might support the mechanical theory. When the attachments of the kidneys are compared with those of the other solid abdominal viscera, their laxity is apparent, and it is hardly to be wondered at that they are so often displaced. The renal artery, vein and ureter, together with the circum-renal celluloadipose tissue, can hardly be considered as sufficient for the fixation of the organ. Thus, it would appear, that the peritoneum is the chief structure concerned in keeping the kidneys *in situ*—a structure not very adequate for this purpose.

It is well known that the kidneys in females are more moveable than in males, and I have verified the fact in a large number of cases in the dissecting room. *It is not therefore difficult to imagine that a very little extra-pressure might displace the kidneys outwards. The result evidently is an elongation of the renal vessels, the consequent diminution of their calibre and hence an obstruction to the flow of blood.*

This increased intra-abdominal pressure comes into play in the multipara, under the following conditions: (1) Women, who though previously pregnant, had never gone to full-term and in whom, therefore, there was no relaxation of the addominal wall; (2) women of extreme muscular development whose rigid fibres do not readily yield to the enlarging womb; (3) plural pregnancies, hydramnios, and an unusually big fœtus.

The opponents of the pressure theory explain the fact that the albuminuria ceases at once, as soon as the pregnancy is over, in the following way: They say that "with the emptying of the uterus a very great change takes place in the distribution of the blood to the abdominal organs, and in the blood pressure in their vessels, a change, in fact, in the tension throughout the entire aortic system, sufficient to remove at once an inflammatory hyperæmia of the kidneys" (Barnes). In this explanation it is assumed that there has been a previous change in the distribution of blood before the uterus was emptied, and if this change reverts to its normal condition, on the emptying of the uterus, the natural conclusion is, that "the gravid uterus" and "the change in the distribution of blood" stand in causal relationship. Surely, the same condition may be explained by the mechanical theory.

The other objections against the mechanical theory are: (1) that albuminuria appears in the early months of pregnancy; (2) that albumen may disappear under treatment by purging and bleeding, although the uterus continues to grow; and (3) that albuminuria and convulsions not seldom occur in multiparæ, though escaped in the first pregnancy.

To the first objection I would say that pregnancy, not only does not preclude, but, rather by renal hyperæmia, predisposes a woman to an attack of

Bright's disease. The second objection can, in reality, be explained by the mechanical theory, and specially the view I have put forth above, the slight pressure of the intestines may displace the kidneys and cause their congestion, and that by purgation this pressure is removed. The third objection may be met by the explanation already given of the increase of intra-abdominal pressure in the multipara.

So much for the mechanical theory. I have dwelt above on the special frequency of eclampsia in primiparæ, especially with reference to the mechanical theory. It appears that there must be in primiparæ some powerful predisposing cause, rendering them liable to the occurrence of convulsions. This cause, I believe, to be a peculiar state of the nervous system, which, in pregnancy and during labour, is in a condition of high tension and increased irritability. The primipara is apt to be irritable, mobile, and excitable, and it is very natural that she should be so. The novel sensation incident to her situation, the dread of her approaching labour, and a degree of anxiety and apprehension as to its result, all tend to produce a state of erethism of the nervous system, strongly predisposing to convulsions.

By whatever cause it may be that the pregnant woman is rendered more susceptible to the exciting cause of nephritis, either by depressed vitality of the patient, or by extra-work thrown upon the kidneys by the pressure of the fœtus and enlarged uterus, or through the effect of a reflex nervous irritation, having its origin in the pregnant uterus, in by far the greatest number of cases we have eclampsia associated with albuminuria. The exciting cause of the convulsions appears to be a poison retained in the blood. The poison need not necessarily be urea or any of its derivatives. It may be waste products of a far more poisonous character, of the nature of *ptomaines.*

Why a pregnant or a parturient woman should have convulsions in consequence of a recent nephritis may be explained by the fact (1) that the form of nephritis associated with eclampsia is especially severe in its effect of diminishing the excretion of solids ; (2) that the reflex excitability is naturally increased in preparation for the process of labour which is carried on through reflex irritation in the presence of the ovum, the occurrence of labour pains and the pressure of the fœtus in the cervix or vagina—as amply proved by eclampsia actually commencing during labour and by the uterine contractions being often the starting point of a convulsion.

I entirely concur with Galabin when he says that " in those cases in which there has been an absence of albuminuria throughout, it appears that these two causes, namely, increased reflex susceptibility and the presence of a source of irritation, complete the whole pathology.

I must now briefly mention the other theories held with regard to the causation of eclampsia.

Halbertsma's theory of " compression of the ureters by the gravid uterus."—Of this theory I am not prepared to say anything beyond, that, in one of the *post-mortems* (the details of which are given in the Appendix), there was dilatation of the pelvis of the kidney (Case No. 42), and in another there was sub-acute pyelitis.

Gubler's theory of " super-albuminosis."—This supposes that the disease depends upon the elimination of excess of albumin which the pregnant woman's blood contains. The kidney, therefore, is not primarily diseased, but serves as a filter. This hypothesis, according to Barnes, contains " a part of the truth." Allied to this theory is that of Peter, who suggests that there is " transudation of albumin " and " auto-typhilisation."

Tyler Smith's theory.—Tyler Smith enunciated the theory that the albuminuria "*may depend upon sympathetic irritation of the kidney*" by the gravid uterus, similar to the irritation of the salivary glands, the mammæ, the thyroid, etc., and not upon mere pressure. Frankenhauser discovered a direct connection between the nerves of the uterus and the renal ganglia, and suggests that the nervous system and not the vascular system is the starting point of puerperal convulsions.

Spiegelberg's theory of " vaso-motor spasm."—After discussing the various theories Spiegelberg sums up thus : True eclampsia depends upon uræmic poisoning, due to an inadequate secretory activity of the kidneys. The latter either arises from renal disease, which has lasted some time previously, and which attains a dangerous degree of severity owing to the gravid or parturient condition. Or else in women who have till then been healthy, it developes more or less rapidly (although always within a short space of time), and is then with great probability caused by an acute affection of the renal vessels ; certain it is, that complete anuria may set in, quite suddenly, through spasm of vessels, and this vaso-motor spasm is to be looked upon as caused in a reflex manner by irritation of the uterine nerves. The increase in the arterial pressure, which is present at the onset of the paroxysm, is a consequence and aggravates the disease.

The Traube-Rosenstein theory.—According to this eclampsia only arises (much as do nervous symptoms in ordinary uræmia) when in a very hydræmic person, the aortic pressure is suddenly raised. Under such circumstances acute œdema of the brain is supposed to result ; the transuded serum compresses the cerebral vessels and leads to acute cerebral anæmia. If this alteration is confined to the cerebrum, coma will follow ; should the middle brain be involved, there will be convulsions.

This theory breaks down for the reason that (1) it utterly fails to explain why eclampsia is so rare, while the pathogenic conditions are supposed to be present in the majority of cases ; something more is, therefore, required to set the paroxysms going, and this something is not supplied by Rosenstein theory; (2) moreover the hydræmia, which is held to be a *sine qua non*, does not exist in most eclamptic women ; indeed, they are often young, vigorous individuals, and conversely the great majority of hydræmic individuals do not suffer from eclampsia, so that in such cases both hydræmia and an increase of arterial pressure do not cause œdema of the skin and brain; (3) the records of autopsies show that there is no evidence of cerebral œdema in these cases, where present it may quite well be secondary, much as may the transudation into the serous cavities. In two of the *post-mortems* in the Appendix, there was serous effusion with anæmia of the brain (Cases Nos. 25 and 35), one had serous effusion, with hyperæmia of brain (Case No. 30), one had serous effusion with cerebral apoplexy (Case No. 34), and in three cases there was anæmia of the brain (Cases Nos. 40, 42 and 97); (4) ordinary uræmic convulsions are most frequent just in those cases in which there is little or no œdema; (5) the theory does not explain the eclampsia of pregnancy and *post-partum* state; (6) finally, the clinical signs of cerebral pressure are absent, and the condition of the pulse and pupils in no way corresponds to that generally accompanying such pressure.

Fœtal theory.—German writers have put forward the idea that the fœtus may have a share in the causation of eclampsia. Winckel points out that Stumpf leaves it undecided whether the material, the cause of the disease in his opinion, is produced by an infectious agent, introduced from without, or whether it may have been transmitted from the child to the mother. On this point Winckel states "the predisposition to eclampsia, in twin and triplet pregnancies, its fatal effect on the child, the fact that dead children in *rigor-mortis* have been extracted from eclamptic patients by Dohrn and Stumpf; and, finally, the fact to which I have drawn attention, since 1865, with reference to the prognosis that with the death of the child during pregnancy the danger for the gravida is much lessened or entirely overcome, all point to the intimate relation which exists between the mother and child in regard to the origin of eclampsia."

Barnes's theory.—"Several conditions concur to cause the associate disorder. These are (1) the hydræmic state of gestation leading to imperfect nutrition of the nervous centres increasing; (2) the normal nervous tension and irritability and (3) the normal vascular tension; with these comes (4) blood poisoning from imperfect elimination of waste stuff by the kidneys and other emunctories."

We may now ask ourselves the question: *What is the connection between albuminuria and eclampsia.*

The case may be stated, as Dr. Byers puts it, in the following way: "Does the kidney affection cause the eclampsia, or does the eclampsia give rise to the abnormal state of the kidneys; or, finally, is there some primary cause occasioning the convulsions, and at the same time giving rise to the kidney lesion?"

Dr. Braxtan Hicks, in a paper read before the Obstetrical Society of London, advanced the view that the convulsion may cause the albuminuria. This fact is attested by Depaul, Legroux, Leavy, Fordyce Barker and others. Barnes, in discussing this point, says:—

> "Accepting the facts cited by Hicks and others, we submit that they have only a limited application to the solution of the problem. If some cases of eclampsia occur, not preceded by albuminuria, but followed by it, it is nevertheless true that in a much larger proportion the albuminuria precedes, or, at any rate, is found abundantly, not after twenty-four hours, but at the time of the first fit. We must then see further back than the fit for the cause of the albumin. The most philosophical explanation appears to be that the high vascular tension, telling upon the kidneys, impairs their working powers, and that from this cause and from the accumulation of noxious stuff, the proceeds of the double nutrition of mother and fœtus, there ensue two things—irritation of the kidneys and irritation of the cerebro-spinal centres. The researches of Mahomed go far to explain the occasional precedence of the fit over the albuminuria, by showing that the kidney is already labouring in the pre-albuminuric period. These researches and the facts observed are further in harmony with the views of Gull and Sutton, which imply that arterial fibrosis and hypertrophy of the heart re-act upon the kidney in causing Bright's disease. The hypertrophy of the heart is a constant condition in gestation, associated with a high tension, and the consequent fulness and tension of the small arteries carries the analogy still closer. One circumstance that lends weight to this view is the increased liability to convulsions at the menstrual epochs, when the nervous and vascular tension is increased. The tension falls when the child dies in utero. There is thus the strong predisposition to exaggerated diastaltic action increased by the imperfect nutrition of the nerve centres: all that is wanted to overthrow the balance is an exciting cause; this is found in the noxious stuff, retained in the blood through imperfect excretion, this irritating the distaltic centre provokes the convulsion."

Dr. Barnes explains the presence of granular casts and epithelial scales, along with albumen in the urine in the following way. Under the dominant vascular tension of pregnancy the mucus membrane of pelvic organs undergoes an intense degree of hyperæmia, which may be called *congestion*, but not inflammation. This hyperæmia in the cervix uteri and vagina is marked by deep red and purple colouration, by tissue engorgement, by the profuse shedding of epithelial scales and exudation of muco-albuminous fluid. A similar condition is supposed to exist in the kidney which is within the sphere of similar influences. Tarnier, DeSinety, Leyden, Sutton, Ewart, Barnes and others' researches, as to changes wrought in the liver in pregnancy, confirms the above facts by analogy. This change is said to be of the nature of cloudy swelling. Byers thinks that "if the kidney is the organ that is specially affected, we have puerperal eclampsia." There can be no doubt that we are only beginning to discover the important bearings that changes in these two organs, liver and kidney, may have on pregnancy. In seven of the nine *post-mortems* in the Appendix, the liver was found soft and fatty-looking.

Eclampsia bacillus of Gerdes.—The hypothesis, by some, that the nephritis is not the cause of the convulsions, but that both nephritis and convulsions are the result of some common cause, is explained by Dr. E. Blanc of Lyons. He claims to have discovered a specific form of bacillus which is the cause of eclampsia. This bacillus he obtained from the urine of patients suffering from eclampsia; it could not be found in the blood. Pure cultures were obtained of this bacillus, and some of the cultures was injected into a vein in the ear of pregnant rabbits. The rabbits suffered from convulsions and dyspnœa and died. The same bacillus was obtained from their urine. Injections of the same cultures into non-pregnant rabbits produced

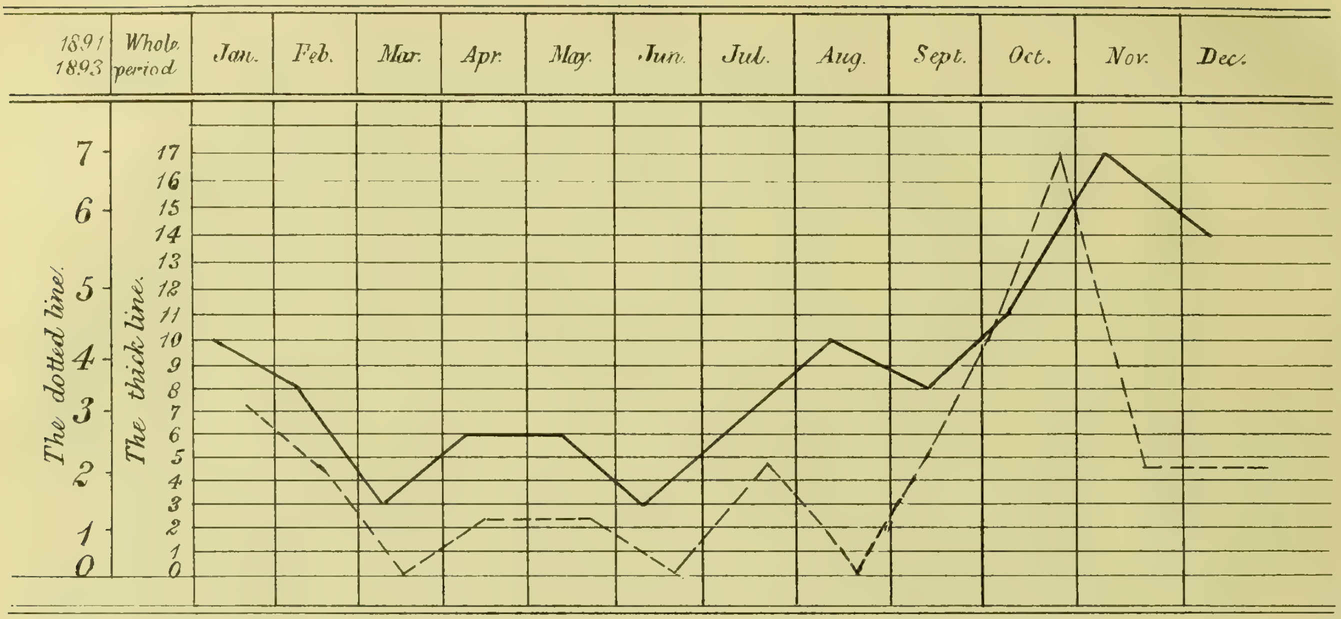

CHART A.

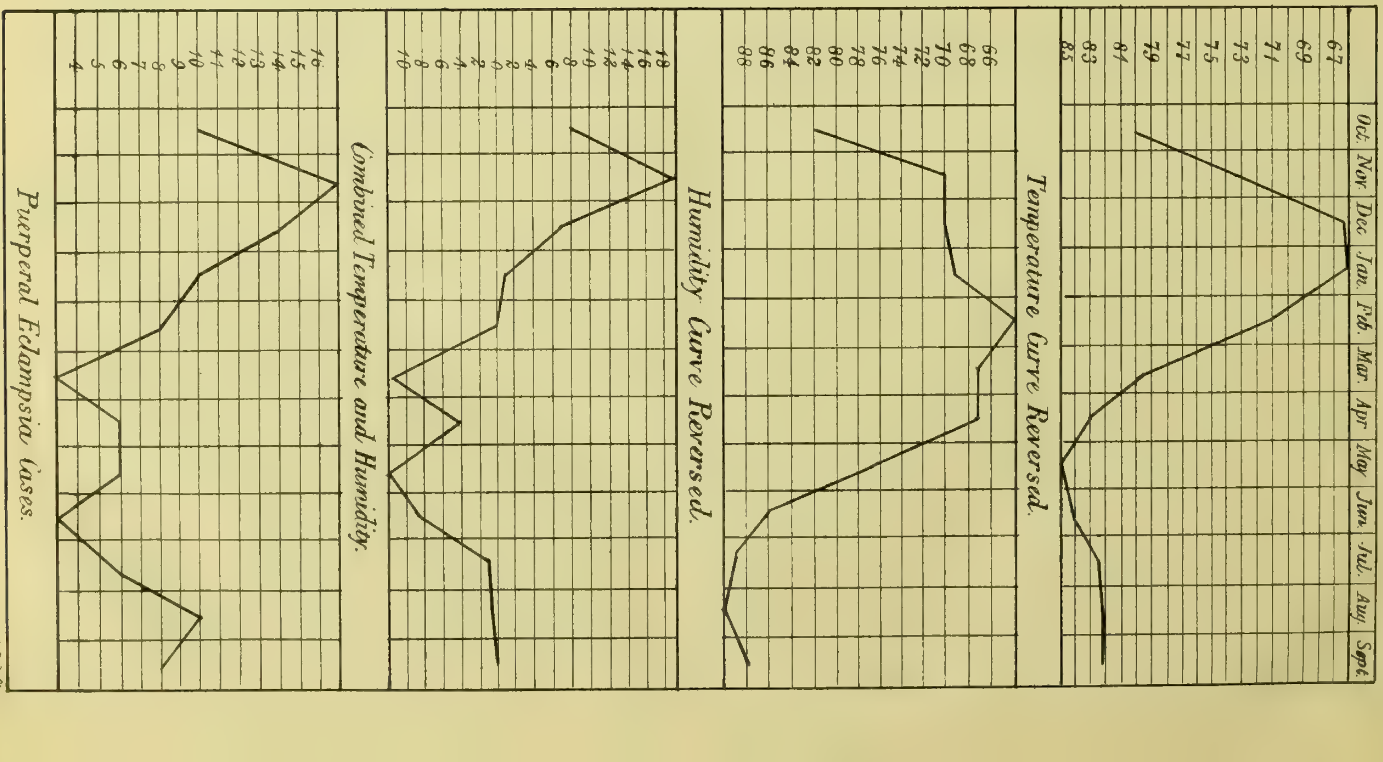

CHART B.

only local inflammation at the site of injection. Injection of the same cultures into dogs, even if non-pregnant, produced convulsions, but the dogs recovered after several days. Gerdes made similar experiments, and arrived at results similar to Dr. Blanc. Hoffmeister and Hagler also investigated the point with negative results.

Doderlein of Leipzig("Centralblatt fur Gynakologie," No. 1, 1893) reports the results of the bacteriological examination of eight cases of eclampsia, which negative those of Gerdes, and agree with those of Hoffmeister and Hagler. The investigations were made from the urine of the mother, in four cases, from the maternal blood, from the blood of the child, from the blood of the placenta, in two cases from the child's urine under careful antiseptic precautions. From this material, about fifty inoculations were made, all of which, with the exception of those from the maternal urine, remained sterile. The culture media, which had been inoculated with the urine of the mother, showed a rich development of the most varied forms of germs, specially bacteria in chains. A number of investigations made upon healthy pregnant women for comparison were convincing of the impossibility of procuring urine, even under the most careful method, without infecting it by the urethral secretions which are rich in bacteria. Doderlein, therefore, draws the conclusion that eclampsia bacillus of Gerdes is not the cause of eclampsia.

Atmospheric influences.—Have atmospheric influences anything to do with the occurrence of eclampsia ? Of the twelve cases that were admitted into the Eden Hospital in 1891, two came in July within four days, two in September within a week, four in October, of which the first three came within a week and the last one within twelve days more. Fordyce Barker met with five cases in one day, and on another day of the same week three cases. The frequency with which these groups of cases occurred within a very short time led me to suspect the influence of atmospheric conditions in producing eclampsia. The table of cases also shows the following facts :—

In 1865 two cases only, both within a fortnight. In 1869 two cases only within twenty-five days. In 1870 there were six cases, four of which came within a period of five weeks, and the other two within two days. In 1875 there were only two cases, *both came in the same day*. In 1877 three cases occurred within twenty days. In 1878 two cases came within three days. In 1879 two cases within five days. In 1881 two cases within four days. In 1886 two cases within a fortnight ; two more within four days. In 1887 two cases within twelve days. In 1889 three cases within a week. In 1890 two cases within two days. In 1893 two cases came within two days ; two more within a fortnight.

It will thus be seen that excluding nine cases, that occurred singly in nine years, from the total number, we have ninety-two cases remaining, out of which more than forty-four cases came in groups within a period ranging from twenty-four hours to thirty-four days.

The cases were distributed in different months as follows :—

PERIOD.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL.
1850-1894 ..	10	8	3	6	6	3		10	8	10		14	101
1891-1893 ...	3	2	0	1	1	0	2	0	3	7		2	23
1891 ...	0	0		1	1	0	2	0	2	4		1	12

From the above table it will also be seen that more cases came in between the months of September and February than during the other months.

	From March to Aug.	From Sept. to Feb.	TOTAL.
1850 1894 ...	34	67	101
1891-1893 ...	4	19	23
1891 ...	4	8	12

I have tried, in Chart A, to compare graphically the distribution of the cases in the whole period (*viz*., of 47 years), with a short period of three years (1891-1893.)

The curves in that chart run almost parallel to each other, and we might safely take the thick line as the average.

The atmospheric temperature and the humidity are the two principal factors with which we have to deal. We know from physiology that a cold temperature diminishes the functional activity of the skin, and that the more saturated the air is with watery vapour, the sooner does the secretion appear in drops upon the skin, while in dry air, or air in motion, the formation of drops of sweat is prevented, or at least retarded. " The *reciprocal* relation between the *skin* and kidneys is well-known." In summer when the skin is active the kidneys separate less water ; in winter when the skin is less active more water is excreted by them, so that the action of these two organs is in inverse ratio.

It then naturally follows that the diminished activity of the skin will tell upon the kidneys, still more so on kidneys which have already more work to do.

Let us now consider whether there is really any connection between these atmospheric influences and the occurrence of eclampsia.

For convenience of description, I have prepared a chart to represent graphically the relationship between (1) atmospheric temperature; (2) atmospheric humidity; (3) combined influence of temperature and humidity ; and (4) the total monthly eclampsia cases (*vide* Chart B.)

The combination of the temperature and humidity requires explanation. Assuming that the diminution of atmospheric temperature and depression of humidity favour the occurrence of eclampsia, and that opposite conditions produce a reverse effect, let us try how we can estimate the combined effect of these influences in each individual month. For convenience of calculation, degrees of temperature and of humidity may be regarded as of equal value in reference to prevalence. We might take September as a month in which the average number of eclampsia cases occur.

The temperature of September is 82°7 and its humidity 88. Passing to October, we have a temperature of 80·6, and a humidity of 82, that is we have an increase in the number of cases favoured by a diminution of 2·1 of temperature and 6 degrees of humidity. Accordingly, there is a total diminution of (2·1 + 6) = 8·1 degrees, in favour of increased prevalence and the conditions of October in respect of temperature, and humidity in relation to prevalence are as +8·1 compared with those of September as zero. Proceeding in the same way with the remaining months, I have obtained the above numbers of the combined influence of temperature and humidity.

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Temperature average (for 39 years) ...	66·5	71·4	79·7	83·4	85·5	84·7	83·1	82·6	82·7	80·6	73·6	66·7
Humidity average (for 8 years) ...	69	64	67	67	77	86	89	90	88	82	70	70
Combined conditions ...	+1·2	+·1	—11·3	—3·7	—12·1	—8·2	—1·4	—·5	0	+8·1	+19	+6·9
Total eclampsia cases ...	10	8	3	6	6	3	6	10	8	10	17	14

The parallelism between the curve of the combined influences and that of the cases is very striking indeed. I admit, however, that I do not consider the proof to be complete. Further inquiry into the subject is necessary, and I only bring these facts forward that the attention of obstetricians may be drawn to them.

In this connection, I have consulted a few of the leading practitioners in Calcutta, and they all tell me that they see more cases of eclampsia between September and February.

In going through the literature of the subject, I find that Smellie, Denman, Ramsbotham, Andral, Duges, Spiegelberg, Lever, Hall Davis, Fordyce Barker, Simpson, McClintock and Olshausen have noticed the fact that " several cases come in rapid succession without any apparent explanation of this occasional frequency, and sometimes not a single case occurring during a long period." McClintock, while admitting that " there are certainly certain seasons in which cases of convulsions occurred with unusual frequency," is still slow to infer, " unless strongly supported by collateral evidence, that atmospheric causes, any more than contagion, had to do with the production of any particular disease ; for the accidental coincidences that frequently occur in practice are most remarkable, even where the bare possibility of any epidemic or contagious influence having been in operation is wholly excluded." None of the writers, above referred to, except Spiegelberg, attempted to give any explanation. Spiegelberg, though more inclined to attribute it to accident, yet throws out a hint that the *quasi*-epidemic occurrence of eclampsia might be brought about by " atmospheric influences, specially affecting the skin,—an organ whose relations to renal activity are, of course, well known."

The sudden alterations in the temperature and humidity of the atmosphere, so common here, might very well interfere with the functions of the skin and lead to congestion of the kidneys. The women of this country are very much exposed to these sudden alterations. One can easily imagine how a cold bath on an early morning, in an open space, with the wind blowing, exposes a person to get chilled. The woman will come out from a closely-packed room, take her bath as described above, and then, changing her wet clothes, will at once go and sit over the fire in the kitchen. This custom prevails in the majority of Bengali houses, and is, to my mind, a very cogent predisposing factor in the causation of renal congestion, and is responsible to a certain degree, at least, for the greater prevalence of eclampsia here.

Relation of the advent of convulsion to labour.—The disease is most frequent during, and least frequent after, labour. Out of 101 cases, there were only four cases of *post-partum* eclampsia, of which one recovered and the others died. Of the remainder, five certainly occurred before labour, as there was no indication of labour on admission. Of these, one was a full-term case, in which labour was brought on, and premature labour had to be artificially induced in the other four cases. The relative frequency of eclampsia in pregnancy and in labour cannot be conclusively determined, for labour so often coming on as a consequence of the convulsive attacks, many of the cases which really belong to gestation are put down as occurring during labour.

	Before labour.	During labour.	After labour.
Winckel ...	... 5·23	60	17 per cent
Schauta ...	... 43	185	82 "
Hall Davis ...	... 8	15	9 "
Wiger (455) ...	... ...	236	...

Period of gestation when eclampsia is more frequent.—Of the 101 cases, 67 were full-term, 27 in their ninth month, 5 in their eighth, 1 in her seventh, and 1 in her sixth.

Mortality.—Of 101 mothers 59 died, or 58·4 per cent. A very high mortality indeed! This cannot bear comparison with any of the figure in the following table, except that of Krassing. But he had only 16 cases, of which 9 died. Again, the table contains the percentages of death of cases fifty years back, since when the mortality has greatly improved. I know that of the twelve cases that were admitted into the Eden Hospital in 1891 six died, *four* of which were *moribund* on admission. It is a fact that we get the worst cases here.

The following table is collected to show the ratio of mortality in different hospitals and in the practice of accoucheurs :—

Authorities.	Total No. of cases.	Death.	Per cent.	Reference.
Hall Davis ...	32	3	9·3	(Private cases).
Royal Maternity Charity, 1820-1850	43	...	7	Ramsbotham.
" ...	...	...	9	Hall Davis.
Leishman ...	...	...	30	
Galabin ...	...	...	30	
Dr. Bland ...	2	...	...	Guy's Hospital Reports, second series. Vol. I, 1843, p. 509.
Mr. Perfect ...	14	5	35·7	
" Gifford ...	4	2	50	
Dr. John Clarke ...	19	6	31·5	
" Smellie ...	8	2	25	
" Merriman ...	36	8	22·2	
" Ramsbotham ...	26	10	38·4	
" Maunsell ...	4	2	50·	
" Collins ...	30	5	16·6	
" Bealty ...	1	...	...	
" Churchill ...	2	...	...	
Mr. Mantell ...	6	2	33·3	
Dr. Lever (Guy's) ...	14	2	14·2	
Total ...	166	44	26·5	
Guy's Charity (up to 1875) ...	...	...	25	
Guy's Charity (1875-1885) ..	...	...		
Spiegelberg ...	...	...	25 or 33	Midwifer., Vol. II, p 210.
Dohrn's statistics ..	747	...	29	Amer, Sys. of Obs., Vol. II, p. 76.
Hofmier ...	...	...	32·4	"
Braun ...	...	...	26	"
M. Charpentier ...	454	110	24·88	
Olshausen ...	200	...	25	British Gynæco Journal, 1892.
Lohlein ...	325	63 14	23·69	14 more died of complications. Edin. Med. Journal, 1891, Sept.
" previous cases	...	...	37·7	Amer. Sys. Obs, Vol. II, p. 76.
M. Bailly ...	119	51	42·85	Medico Chirurg Re. 1860, Vol. II., p. 555.
Krassing ...	16	9	56·25	
Casati ...	7	...	...	Lying-in Hospital, Milan, 1865.
Hugenberger ..	...	...	35·1	Amer. Sys. Obs., Vol. II., p. 76.
Depaul ...	132	50	37·87	"
Theophilus Parvin	...	...	30	
Boston Lying-in Hospital ..	36	9	25	Dr. Green, Amer. Journal Obs., 1893, No. 1
Lying-in Hospital, Dublin ...	36	12	33·3	McClintock, Smellie's Midif., Vol. II, p. 351.
Lying-in Hospital, Dublin (1847-1854)	63	13	20	Johnston and Sinclair's Report.
Fordyce Barker ...	71	9	12 67	Puerperal Diseases, p. 126.

N. B.—It is higher than in any published records in Europe.

Fœtal Mortality.—Of 105 children, 55 were born dead, 45 living, 5 not mentioned whether born alive or not. This gives a mortality of 52%.

Spiegelberg ...	...	50 per cent.
Winckel ...	...	77 "
M. Charpentier ...	...	36·12 "
Krassing ...	...	17·3 "
Casati ...	...	14·2 "
Galabin ...	...	50 "
Lever ...	...	26·6 "
Hall Davis ...	...	38·4 "

Twins.—Of the 101 deliveries, four were twins. Winckel had 69 twins in 627 deliveries.

Presentation.—Of the 97 single deliveries, two only presented by the breech, and the remainder by the head. Of the twin deliveries, four presented by the head, two by the breech, and there is no mention of the other two. In the report of Dublin Lying-in Hospital, out of 30 cases only one presented preternaturally. Krassing had 16 cases with one breech.

Mode of delivery :—

Natural	36
Forceps	52
Version	1 (and another in one of twin)
Craniotomy and cephalotripsy	2
Induction of labour ...	5
Not delivered	4
Barnes' bag and manipulation in breech	1

Albumen in urine.—In all the cases in which the urine was examined, albumen was found, though in a variable quantity.

Temperature.—Moderate rise of temperature (103°—105° F.) was observed in many cases, but there was hyperpyrexia in three cases, in two the temperature rose to 107° F., and in the other to 106° F.

Morbid anatomy.—Analysis of the nine *post-mortem* examinations, given in detail in the Appendix, shows that—

(1) There was serous effusion in four cases, engorgement of the vessels in eight cases, anæmia of brain substance in five cases, its hyperæmia in two, cerebral apoplexy in one, and cerebral softening in one.

(2) Lungs congested in seven, pneumonic in two pyæmic infarctions in one.

(3) No fluid in the pleural cavity in eight cases, there was only an ounce of sanious fluid in the left pleura of one case.
(4) Heart hypertrophied in three cases, mitral obstruction with hypertrophy in one case.
(5) Pericardium contained a little fluid in eight cases,
(6) No effusion in the peritoneum in eight cases, only in one case there was ten ounces of sanious fluid.
(7) Liver soft and fatty-looking in seven cases, firm and anæmic in one, and congested in one.
(8) Kidneys either congested or acute or chronically inflamed.

Treatment.—When we meet with a case of puerperal eclampsia, our first duty is, in my opinion, to control the convulsions by *profound narcosis.* Here *chloroform* is our sheet anchor. The patient should be brought under its influence as quickly as possible. A word of caution here: Where the uterus is greatly distended, death sometimes follows the inhalation of a small amount of chloroform. In these cases the membranes should be ruptured before beginning the narcosis. When the patient is under, the bladder is to be emptied, the lower bowels cleared by a large enema, and 5 grains of calomel with two drops of croton oil may be put on the tongue. An injection of chloral (say, 30 grains rubbed up with the yolk of an egg and a few ounces of milk), is then to be given *per rectum.* This will help to maintain the narcosis. The uterus should then be emptied *as rapidly as possible.* There is no doubt that eclampsia ceases in by far the majority of cases (93·75% Duhressen) after the uterus has been emptied during profound narcosis. It might *positively* be asserted that the mortality from eclampsia is less after operative emptying of the uterus than after spontaneous labour; the mortality will become still less if operative measures are instituted as soon as attacks begin. Operative procedures increase the danger in eclampsia cases, *only when the narcosis is not a deep one.*

If we find the os dilated sufficiently to admit the blades of the forceps, these should be put on at once. On the other hand, if the os be only slightly dilated, or not at all, treatment is best carried out by dilatation with Barnes's bags followed by delivery by forceps. I prefer the long forceps, whenever I can use it, to turning. After the placenta has been expelled, an intra-uterine injection of some antiseptic lotion should be given. As diapers, pledgets of antiseptic cotton wool are most advantageously used in private houses.

Authorities are almost unanimous, at the present day, about the propriety of *inducing premature labour* in those cases where convulsions come on during gestation. I entirely concur with the very strong arguments put forward by Barnes in favour of this method of treatment.

Barnes, while admitting that some women have, under his own observation and sanction, gone to the full period of gestation and been delivered of living children, apparently without damage, frankly says, that with enlarged experience he would not again encounter *a responsibility so great.*

Having come to the conclusion that premature labour is to be induced, the question comes how to do it? I should effect rapid delivery under deep anæsthesia by dilating the cervix with Barnes' dilators, which I should remove, when expelled from the uterus, without emptying them of their contents, thus effecting dilatation of the whole canal. When the cervix is sufficiently dilated to allow of it, I should at once rupture the membranes and apply the forceps, when slight traction will suffice to cause the head to act as a most efficient dilator. A little more pulling will bring the head through the pelvis. The vagina and perineum offer no more than ordinary resistance, they having been well stretched in the process of cervical dilatation, as already described.

In support of the treatment of rapid delivery, there are the following arguments:—

(1) Uterine contractions are entirely avoided by the deep anæsthesia.

(2) Duration of labour reduced to a minimum.

(3) Results to mother and child more satisfactory.

After the completion of labour, some diaphoretic measures should be adopted, to make the skin act vigorously. I strongly recommend the use of the vapour bath, and can testify to its efficacy. The results in three of my cases in private practice have been very satisfactory indeed.

Of venæsection, I cannot say anything from personal experience. In the years 1885, 1886, and 1887 several cases were treated by Surgeon-Colonel Harvey in the Eden Hospital with blood letting in the form of a large number of leeches, and the results seemed very satisfactory. Chloroform was also used in these cases.

It only remains for me to bring before you for discussion a few remarks on the use of pilocarpine.

Professor Andrew Smith says: "If in a desperate case we decide upon the use of pilocarpine, it must be with the consent of patient's friends, based upon a full understanding of the danger." This might be too grave a view to take of the dangers attending its use. Certainly, great care and discrimination should be shown in its exhibition. During coma, it should never be used, as it produces an abundant flow of saliva and a copious secretion of the mucus membrane lining the air-passages, which might lead to urgent symptoms of suffocation.

If, however, we decide upon its use in a suitable case, it is better that the dose should be small at first, say, two doses of a twelfth of a grain each at intervals of quarter of an hour.

In the appended table there are twelve cases in which pilocarpine was used, of which six recovered and six died. The results so far has not been satisfactory.

I may perhaps be pardoned, if, before concluding, I enumerate the various points I have endeavoured to lay before you for the purpose of discussion. They are:—

(1) Greater frequency of eclampsia in Calcutta.
(2) The mortality, maternal and fœtal.
(3) The mechanical theory, explaining the production of renal congestion.
(4) Influence of atmospheric conditions on eclampsia.
(5) The obstetric management by rapid delivery.
(6) Use of the vapour bath and pilocarpine.
(7) Venæsection.

APPENDIX OF CASES.

No.	Name.	Age	Race and Religion.	No. of Preg.	Period of Preg. (Mos.)	No. of hours in hospital before delivery accomplished.	Labour.	Presentation.	Fœtus dead or alive.	Wt. of fœtus lb.	Wt. of placenta oz.	Admitted.	Delivered.	Discharge or Died.	Result.	Albumen.	Bleeding. * L=Leeches.	Chloroform used.	REMARKS.
1	Rama ..	82	Bengali Hindu ..	1	9	....	Natural ..	Head ..	L. F.	..	..	23 3 50	11 4 50	28 4 50	R.	...	*	..	Calomel and hemp.
2	Dhalkin ..	22	Hindu ..	1	9	....	......	Head ..	....	..	..	13 9 59	13 9 59	13 9 59	D.	..	..	...	Head low in the pelvis on admission; died, undelivered a few hours after.
3	Tonee ..	20	Hindu ..	1	9	8	Low Forceps ..	Head ..	D.	...	..	16 9 61	16 9 61	17 9 61	D.	*	..	*	
4	Prosonno ..	30	Bengali Hindu ..	1	8	24	Low Forceps ..	Head ..	D.	..	..	13 10 63	14 10 63	15 10 53	D.	..	..	*	P.-M. cranial cavity contained 8ozs. of fluid, kidneys-normal.
5	Shoro ..	16	Bengali X'tian ..	1	9	10	Low Forceps ..	Head ...	D.	..	..	15 8 64	15 8 64	0 0 64	R.	..	..	*	Unconscious for 22 hours after delivery. Admitted ten hours after convulsions began.
6	Nistarini ..	16	Bengali Hindu ..	1	9	10	Low Forceps ..	Head ..	D. F.	..	..	27 11 65	27 11 65	27 11 65	D.	...	*	*	Os rigid, notched with bistoury.
	Wooma ..	25	Bengali Hindu ..	1	9	3½	Low Forceps ..	Head ..	D	4¾	..	11 12 65	11 12 65	11 12 65	D.	..	..	..	Os fully dilated on admission.
	Anno ..	30	Bengali Hindu ..	1	8	....	Natural ..	Head ..	L. M.	5½	..	0 11 68	5 1 68	30 1 61	R.	...	..	..	
9	Mrs. G. ..	17	Jewess	2	5	....	Natural ..	Head ..	L. F.	...	..	29 1 68	30 1 68	30 1 68	D.	..	..	..	
	Luckmi ..	20	Hindustani Hindu ..	1	9	2¼	Natural ..	Head ..	D.	3 11/16	7¾	26 5 69	26 5 69	26 5 69	D.	...	...	..	Os fully dilated on admission.
11	Monmohini ..	17	Bengali Hindu ..	1	9	1	Low Forceps ..	Head ..	D.	5½	12	4 8 69	5 8 69	5 8 69	D.	..	..	*	Os fully dilated on admission.
12	Ilphut ..	17	Mahomedan ..	1	9	1	Low Forceps ..	Head ..	D.	4⅚	11½	11 9 69	11 9 69	12 9 69	D.	..	..	*	
13	Hema ..	17	Bengali X'tian ..	1	9	....	......	Head ..	....	..	..	21 6 70	9 6 70	22 6 70	D.	..	..	*	Convulsions came on with labour while the patient in hospital. Died undelivered in two hours.
14	Parbati ..	16	Bengali Hindu ..	1	9	1	Low Forceps ..	Head ..	D. M.	4⅞	9½	8 7 70	8 7 70	8 7 70	D.	...	...	..	
15	Bama ..	20	Bengali Hindu ..	1	9	....	Low Forceps ..	Head ..	D. M.	4⅞	14	23 7 70	24 7 70	30 8 70	R.	..	..	*	Seven fits before delivery.
16	Amiran ..	45	Mahomedan ...	3	8	....	......	Head ..	....	..	..	25 7 70	9 7 70	25 7 70	D.	...	...	..	Os only one finger dilated. Died undelivered. Had only one fit.
17	Bimala ..	24	Bengali Hindu ..	1	9	....	Natural ..	Head ..	L. F.	4 3/16	12	27 10 70	25 12 70	3 2 71	R	..	...	...	Convulsions continued for 48 hours.
18	Kamini ..	16	Bengali Hindu ..	1	9	15	Natural ..	Head ..	D. F.	..	..	25 12 70	26 12 70	26 12 70	D.	..	..	*	Vapour bath.
19	Dhoni ..	20	Bengali Hindu ..	1	8	....	Low Forceps ..	Head ..	L. F.	5¾	16	2 2 71	3 2 71	26 2 71	R.	...	..	*	
20	Bhobo ..	20	Bengali Hindu ..	1	8	....	Natural ..	Head ..	D. M.	4	..	9 3 71	13 3 71	27 2 71	R.	..	..	..	
21	Apron ..	19	Bengali Mahomedan	1	9	....	Natural ..	Head .. Head ..	L. M. L. F.	3½ 4	.. ..	19 2 73	19 2 73	19 2 73	D.	..	...	*	Twins. Died eight hours after admission.
22	Mrs. A. ..	30	Armenian ..	1	8	....	Labour induced ..	Head ...	D.	5¼	15	3 11 73	4 11 73	4 11 73	D.	*	...	..	Died before delivery.
23	Mrs. D. ..	22	East Indian ..	2	9	....	Natural ...	Head ..	L. F.	5½	17	1 8 74	1 8 74	14 8 74	R.	...	...	..	
24	Mrs. S. ..	20	East Indian ..	1	8¾	....	Natural ..	Head ...	L. F.	6¾	17	8 12 74	9 12 74	25 12 74	D.	*	..	...	
25*	Champa ...	20	Bengali Hindu ...	1	8	....	Natural ..	Head ..	D. M.	4¾	12	27 12 74	27 12 74	28 12 74	D.	*	..	..	
26	Mrs. P. ...	24	East Indian ..	2	8¾	....	Natural ..	Head ..	L. M.	4½	12	7 12 75	11 12 75	21 12 75	R.	*	..	...	
27	Mrs. S. ...	17	East Indian ..	1	8	....	Natural ..	Head ..	L. F.	6½	17	11 12 75	11 12 75	10 1 76	R.	*	..	..	
28	Bidu ..	20	Bengali Hindu ...	1	8¾	....	Natural ..	Head ..	D. F.	3¼	8	8 1 76	8 1 77	25 1 76	D.	..	..	..	Died of Gangrene of lungs.
29	Shona ..	25	Bengali Hindu ..	2	8¼	....	Natural ..	Head ..	D. M.	4¾	15	16 1 77	16 1 77	22 1 77	R.	*	..	...	Had cholæmia.
30*	Kamini ..	19	Bengali Hindu ..	1	8½	....	Natural ..	Head ..	D. M.	5¼	12	1 4 77	1 4 77	3 4 77	D.	..	...	..	
31	Christiana ..	20	Madrassi X'tian ..	1	8	....	Natural ..	Head ...	L. F.	6¼	13	6 4 77	7 4 77	18 4 77	R.	..	..	..	
32	Koolsam ..	14	Bengali Mahomedan	1	8	....	Natural ..	Head ..	D. M.	4¼	12	20 4 77	20 4 77	27 4 77	R.	..	..	..	
33	Mrs. D. ..	40	East Indian ..	13	8¾	....	Natural ..	Head ..	L. F.	5⅞	14	26 5 77	29 5 77	6 6 77	R.	*	..	..	
34*	Hari Dassi ..		Bengali Hindu ..	1	9	....	Natural ..	Head ..	L.	..	..	23 6 77	2 6 77	25 6 77	D	..	..	..	
35*	Rosha ..	24	Bengali Hindu ..	1	7½	....	Natural ..	Head ..	D. M.	2⅓	..	2 7 77	23 8 77	15 9 77	D.	¼	...	...	
36	Mrs. R. ..	21	East Indian ..	1	9	....	Natural ..	Head ...	D. M.	6⅜	19	7 2 78	7 2 78	7 2 78	D.	..	..	..	Died ten hours after admission.
37	Kariman ..	17	Bengali Mahomedan	1	9	6	Natural ...	Head ..	L. M.	5½	15	3 8 78	3 8 78	4 8 78	D.	..	..	..	
38*	Monmohini ..	30	Bengali Hindu ..	1	8	....	......	Head ..	....	..	..	14 11 78	....	14 11 78	D.	⅛	..	..	Died undelivered two hours after admission.
39	Rebecca Solomon ..	22	Jewess ..	1	9	....	Forceps ..	Head ..	L. M.	6¾	17	27 12 78	27 12 78	6 1 79	R.	...	..	..	
40*	..onmoni ...	20	Bengali Hindu ..	1	6	....	Natural ..	Head ..	— —	.. ..	.. ..	2 1 79	30 12 78	4 1 79	D.	..	..	..	
41	Arfoon Bibee ..	15	Bengali Mahomedan	1	9	....	Natural ..	Head ..	L. M.	6	21	3 3 79	3 3 79	10 3 79	R.	..	..	..	
42*	Pantho ..	27	Uriya Hindu ..	2	7	....	Natural ..	Head ..	D. F.	3½	17	22 11 79	22 11 79	27 11 79	D.	..	..	*	
43	Harimoti ..	25	Bengali Hindu ..	5	9	....	Natural ..	Head ..	D. M.	5½	19	26 11 79	27 11 79	1 12 79	D.	..	..	*	Suc. Conii used.
44	Thako ..	20	Bengali Hindu ..	1	9	....	Forceps ...	Head ..	..	..	..	13 6 81	13 6 81	16 6 81	D.	..	..	..	
45	Mrs. R. ..	17	East Indian ..	1	8	....	Natural ..	Head ..	D. F.	2¼	10	1 12 81	1 12 81	6 12 81	R.	..	..	...	Convulsions continued for 28 hours.
46	Garab ..	28	Bengali Hindu ..	2	9	....	Forceps ..	Head ..	D. M.	6⅜	16	5 12 81	5 12 81	5 12 81	D.	..	..	..	Died a few hours after admission.
47	Anne Baptiste ..	40	Chinese X'tian ..	13	9	....	Forceps ..	Head ..	D. M.	1½	32	21 11 82	21 11 82	21 11 82	D.	..	...	..	

No.	Name.	Age	Race and Religion.	No. of Preg.	Period of Preg. (Mos.)	No. of hours in hospital before delivery accomplished.	Labour.	Presentation.	Fœtus dead or alive.	Wt. of fœtus lb.	Wt of placenta oz.	Admitted.	Delivered.	Discharged or Died.	Result.	Albumen.	Bleeding.* L.=Leeches.	Chloroform used.	Remarks.
48	Bindu	20	Bengali Hindu	1	9	....	Forceps	Head	L. M.	6½	16	6 11 83	7 11 83	12 11 83	D.	½	..	...	
49	Shahajadi	16	Bengali Mahomedan	1	9	2	Forceps	Head	L. M.	5¾	20	12 8 84	12 8 84	1 9 84	R.	½	..	..	P. P. hæmorrhage.
50	Subadra	30	Bengali Hindu	3	9	....	Natural	Head	L. F.	6	17	14 4 85	15 4 85	24 4 85	R.	..	...	..	
51	Mrs. W.	21	European	1	9	....	Natural	Head	L. M.	8	18½	28 8 85	29 8 85	30 8 85	D.	1/16	12L.	*	
52	Mrs. S.	27	East Indian	5	9	....	Forceps	Head	D. M.	8½	14	15 1 86	15 1 86	25 1 86	R.	..	..	...	
53	Sukhoda	18	Bengali Hindu	1	9	....	Natural	Head	L. F.	6	13	9 2 86	9 2 86	3 3 86	R	..	..	..	
54	Jaharan	22	Mahomedan	1	9	At once	Forceps	Head	L. F.	6	15	12 8 86	12 8 86	13 8 86	D.	..	..	...	Chloral given.
55	Ghasikia	16	Hindustani Hindu	1	9	At once	Forceps	Head	L. M.	4¼	20	28 8 86	28 8 86	9 9 86	R.	..	L.	*	
56	Biraj	35	Bengali Hindu	3	9	At once	Forceps	Head	L. M.	6⅜	16	21 11 86	21 11 86	2 12 86	R.	...	..	..	
57	Thakur Dassi	15	Bengali Hindu	1	9	At once	Forceps	Head	L. M.	6½	11	25 11 86	25 11 86	14 12 86	R.	..	L.	*	Forceps before full dilation of os.
58	Tripura	13	Bengali Hindu	1	8	At once	Forceps	Head	L. M.	5¾	12	13 1 87	13 1 87	1 2 87	R.	..	L.	..	Convulsions eight hours before admission.
59	Mrs. G.	25	East Indian	1	9	At once	Forceps	Head	L. M.	6¼	20	27 2 87	27 2 87	12 3 87	R.	..	20L.	*	Unconscious for two days after delivery.
60	Satyabala	30	Bengali Hindu	1	9	At once	Forceps	Head	D. F.	7¼	17	22 5 87	22 5 88	24 5 87	D.	*	L.	*	P. P. hæmorrhage. Temp. 107° F. before death.
61	Mono	18	Bengali Hindu	1	8	At once	Forceps	Head	D. M.	5½	14	25 8 87	25 8 87	27 8 87	D.	*	L.	*	Temp. 106° F.
62	Lahiman	20	Hindustani Hindu	1	9	At once	Forceps	Head	D. M.	7⅜	16	23 9 87	1 10 87	11 10 87	R.	...	...	...	P. P. hæmorrhage. Three fits altogether.
63	Sarojini	25	Bengali Hindu	2	9	....	Labour induced	Head	L. M.	5½	12	12 10 87	13 10 87	11 10 87	D.	¾	L.	..	Second stage six hours.
64	E. Sirkar	21	Bengal X'tian	1	9	....	Twins	Breech Breech	L. F. L. F.	4 4	.. ..	24 7 88	31 8 88	0 9 87	R.	¾	..	..	
65	Bakridia	18	Hindustani Hindu	1	9	At once	Forceps	Head	D. M.	4½	9	25 9 88	25 9 88	25 9 87	D.	..	..	*	Eclampsia for 48 hours.
66	Radha	32	Bengali Hindu	1	9	....	Forceps	Head	L. M.	4½	16	17 11 88	21 11 88	21 11 88	D.	...	...	*	
67	Majathen	18	Hindustani Hindu	1	9	23 minutes	Natural	Head	D. M.	4⅝	11	5 11 89	5 11 89	6 11 89	D.	..	..	..	Second stage six hours.
68	Panchu	16	Bengali Hindu	1	9	At once	Forceps	Head	D. M.	6⅛	14	16 11 89	10 11 89	26 11 89	R.	⅙	...	...	Pilocarpine used.
69	Basanto	13	Bengali Hindu	1	9	....	Natural	Head	D. M.	6⅜	13	12 11 89	12 11 89	......	R.	...	...	..	
70	Bhamo	20	Bengali Hindu	1	9	....	Forceps	Head	D. M.	4¾	12	13 12 89	13 12 89	8 1 90	R.	..	..	..	
71	Fakir Dassi	25	Bengali Hindu	4	9	At once	Barnes's bags	Head	D. M.	4⅜	9	22 5 90	22 5 90	22 5 90	D.	¾	..	...	Died 2¾ hours after admission.
72	Jamuna	18	Bengali Hindu	1	9	At once	Forceps	Breech	D. F.	6½	16	14 9 90	14 9 90	14 9 90	D.	..	...	..	
73	Niroda	25	Bengali Hindu	1	9	At once	Barnes's bags and Forceps	Head	L. F.	4½	8	10 11 90	11 11 90	22 11 90	R.	..	..	..	Pilocarpine Gr. ⅓ (two injections)
74	Dukhobala	17	Bengali Hindu	1	9	At once	Barnes's bags and Forceps	Head	L. F.	4⅞	13	23 11 90	23 11 90	2 1 91	R.	..	..	..	Pilocarpine and morphia. Puerperal mania.
75	Tulsi Dassi	12½	Bengali Hindu	1	8½	At once	Barnes's bags and Forceps	Head	L. F.	5¾	10	23 4 91	23 4 91	6 5 91	R.	½	..	*	Pilocarpine Gr. 1/10.
76	Barada	24	Bengali Hindu	1	8	At once	Barnes's bags and Forceps	Head	L. M.	6¾	18	10 5 91	11 5 91	30 5 91	D.	...	..	*	Temp. 106° F. Pilocarpine.
77	Kiro	15	Bengali Hindu	1	8	At once	Barnes's bags and Forceps	Head	D. M.	5⅝	16	24 7 91	24 7 91	25 7 91	D.	..	..	*	Pilocarpine.
78	Satya	13	Bengali Hindu	1	9	At once	Barnes's bags and Forceps	Head	D. F.	5⅔	10	28 7 91	28 7 91	20 8 91	D.	..	..	*	Pilocarpine Gr. 1/10.
79	Nisi	35	Bengali X'tian	1	9	At once	Barnes's bags and Forceps	Head	D. F.	6	15	10 9 91	10 9 91	10 9 91	D.	..	..	*	
80	Kumudini	14	Bengali Hindu	1	9	....	Natural	Head	D. F.	4¼	4	15 9 91	17 9 91	30 9 91	R.	⅔	..	*	Pilocarpine not given.
81	Kusum	19	Bengali Hindu	1	9	At once	Forceps	Head	D.	..	..	11 10 91	11 10 91	10 10 91	D.	..	..	*	Died soon after admission. Temp. 105° F.
82	Sarasibala	14¾	Bengali Hindu	1	2	At once	Barnes's bags and Forceps	Head	D. M.	3⅞	12	16 10 91	16 10 91	17 10 91	D.	⅛	..	*	Pilocarpine Gr. 1/10 three doses at intervals of 12 hours.
83	Kali Dassi	12	Bengali Hindu	1	9	At once	Forceps	Head	D. M.	3⅞	9	19 10 91	19 10 91	31 10 91	R.	¾	..	*	Pilocarpine 1/12.
84	Brojo	20	Bengali Hindu	1	8⅓	....	Labour induced	Head	D. M.	3¾	10	30 10 91	31 10 91	8 11 91	R.	⅔	..	*	No pilocarpine.
85	Kamini	16	Bengali Hindu	1	8	....	Cephalotripsy	Head	D.	..	..	30 11 91	30 11 91	11 12 91	D.	...	..	*	"
86	Dukhia	17	Hundustani Hindu	1	9	12½ hours	Forceps	Head	L. F.	4¼	10	16 12 91	16 12 91	24 12 91	R.	½	..	*	"
87	Mrs. K.	28	European	1	8	....	Barnes's bags and Forceps (Labour induced)	Head	D. F.	5½	8	24 12 91	6 1 92	12 1 92	D.	⅔	..	*	"
88	———	28	Bengali Hindu	2	9	At once	Forceps	Head	D.	4½	7	2 2 92	2 2 92	2 2 92	D.	¾	..	*	"
89	Guru Dasi	17	Bengali Hindu	1	9	....	Forceps	Head	L. F.	4⅜	8	12 10 92	13 10 92	29 10 92	R.	⅙	..		Died within an hour of admission.
90	Ramsatan	15	Mahomedan	1	9	....	Forceps	Head	D. M.	5¼	12	19 11 92	19 11 92	20 11 92	D.	..	..	*	Pilocarpine ¼ grain.
91	Shoro	25	Bengali Hindu	1	9	At once	Forceps	Head	L. F.	5¾	14	28 12 92	28 11 92	29 12 92	D.	1/10	*	*	No pilocarpine.
92	Hira	30	Bengali Hindu	1	9	At once	Forceps Version	Head Head	D. F. D. F.	3⅞ 2⅝	20 20	7 1 93	7 1 93	7 1 92	..	...	..	...	"
93	Hamidan	30	Mahomedam	1	7	....	Labour induced	Head	D. F.	3	6	9 1 93	9 1 93	10 1 93	D.	...	..	..	Pilocarpine.
94	Bageswari	17	Bengali Hindu	1	7	....	Natural	Breech	L. F.	3½	4	1 2 93	1 2 93	5 2 93	D	⅙	..	..	Pilocarpine.
95	Mulia	15	Mahomedan	15	8	At once	Forceps	Head	D. F.	4⅛	13	20 9 93	20 9 93	1 10 93	R.	Tr.	..	..	No pilocarpine.
96	Soshi	22	Bengali Hindu	1	9	At once	Forceps	Head	L. F.	6⅝	15	12 10 93	12 10 93	24 10 93	R.	..	..	...	"
97*	Kusum	20	Bengali Hindu	1		At once	Forceps Version	Head Head	L. M L. F.	4⅕ 4⅕	21	26 10 93	26 10 93	28 10 93	D.	..	.	..	
98	Rani	14	Bengali Hindu	1	9	At once	Forceps	Head	L.	6¼	13	13 1 94	13 1 94	28 1 94	R	..	...	...	
99	Mrs. M.	25	East Indian	1	9	....	Natural	Head	L.	..	..	31 1 94	2 2 94	5 2 94	D.	..	..	...	
100*	Rani Dasi	16	Bengali Hindu	1	9	At once	Craniotomy	Head	D. F.	4⅜	14	18 3 94	18 3 94	20 3 94	D.	*	..	..	
101	Radhárani	15	Bengali Hindu	1	9	At once	Forceps	Head	....	...	..	22 5 94	22 4 94	25 5 94	D.	..	..	..	

DISCUSSION.

M. E. Staley (Delhi) remarked that the author of the paper had not dealt very fully with the various theories of causation, especially that of Gerdes, though this had been refused. Many careful observers had quite failed to detect any morbid renal changes whatever. It was also pointed out that as yet no proportion had been noticed between renal changes and the severity of convulsions. Attention was drawn to what was considered an effective treatment—Duhresen's by free incision of the vaginal cervix to render delivery easy.

Nil Ratan Sircar (Calcutta) said that his experience did not agree with that of Dr. Kedar Nath Dass with regard to the seasonable prevalence of eclampsia. It was to be remembered that parturition was as common during winter as summer months. He found cases occurred as much in winter as in summer. Of his own eleven cases, all *primiperæ*, two were below 13, six were 13, two were 14 and one was 25 years of age. Early child-bearing seemed to be a distinct predisposing cause.

Joubert (Calcutta) wished to offer a few words of explanation as regards the frequency of eclampsia in India as compared with Europe shown in Dr. K. N. Dass' tables. In England and Europe generally, and also in America, large numbers of women are confined at their homes by students attending the hospitals under what is called the system of maternities. Dr. Joubert explained the system, and showed that the European records quoted referred to large numbers of ordinary labour cases occurring in the neighbourhood of the hospital. On the other hand, the records of the Eden Hospital, Calcutta, referred only to the cases brought to hospital, consisting always of a large number of bad cases, often brought in when in a condition of extreme danger from dystocia. Hospital cases, therefore, always include a much larger percentage of bad cases including eclampsia. Dr. Joubert however wished to record his opinion that puerperal eclampsia was really much more frequent in Calcutta than in Europe, and he considered it due, as already stated by Dr. K. N. Dass, to the premature maternity so common in India. Children of 12, 13, or 14 years of age, immature in every respect, are subjected to the strain of pregnancy and child-birth. The nervous system gives way under the strain and eclampsia results with such frequent loss of life of both mother and child.

The President remarked that puerperal eclampsia was less frequently met with in Bombay, and that most of the cases were seen in the rains when there is a diminution of vital functions, and the exhalations of the skin being less easily carried off, more waste products accumulate in the blood. A similar reason would account for the greater frequency of eclampsia in cold weather. He agreed with Dr. K. N. Dass that eclampsia was associated with premature maternity and an easily unbalanced state of the nervous system. Delivery by relieving the tension of the nervous system opened the way to recovery. Nature helps delivery by contraction of the uterus during spasms. He considered that incision of the cervix to promote delivery was justifiable.

THE MORBID ANATOMY AND PATHOLOGY OF THE FORM OF BILIARY CIRRHOSIS WHICH OCCURS IN CHILDREN IN INDIA.

BY J. B. GIBBONS, M. B.,
Surgeon-Major, I. M. S.

In February 1888, I brought before the Calcutta Medical Society the liver of a child who died in the Eden Hospital, and expressed my belief that it was an example of the disease of the liver in children which was then, and continues to be, the subject of much discussion among medical men in Calcutta. From the changes found in this liver I arrived at the conclusion that the so-called infantile liver, as to the nature of which many different views were held, was biliary cirrhosis. At first this view met with opposition, and some medical men held that my case was not an example of the infantile liver. In the following year I was able to show the livers of three children who died in the Medical College Hospital. These three livers presented similar appearances to those found in the first case, and as the history and symptoms corresponded with those of infantile liver, the correctness of my view was generally accepted.

In the " Scientific Memoirs by Medical Officers of the Army of India," Part VI, 1891, I have described the morbid anatomy of the disease and called it " A form of biliary cirrhosis." I was led to make this qualification on further study of sections of the four livers, and especially owing to the appearances present in sections of the liver of a child who died at an earlier stage of the disease. This case, which is referred to as case No. 5, is of great importance, as in it the disorganization of the liver structure is less advanced than in the previous cases, and consequently the origin and course of the morbid process can be traced. From the appearances found in the liver, I was led to suggest that the name *intercellular* cirrhosis would be more appropriate, and would indicate the primary development of fibrous connective tissue within the lobules between the liver cells. I have, however, kept to the name by which the disease is now generally known, and which draws attention to the state of the bile-ducts—a feature of the greatest importance in connection with the process of recovery. I would, however, suggest that the necessity of prefixing the qualification indicated by the words " a form," as unquestionably the disease is different from biliary cirrhosis known in Europe and described by European writers. In making this assertion, I am supported, not only by the absence of description corresponding with the appearances found in these livers in any of the books which I have been able to examine, but also by the opinion of two of the foremost pathologists in Europe. When working at the Anatomico-Pathological Institute in Vienna in 1892, I took the opportunity of showing sections from the livers of my seven cases to Professor R. Paltauf. He was greatly interested in the disease, not only because of it being new, but also owing to certain peculiar features which it presents. He considered the subject of sufficient importance to be shown to Professor Kundart, the Senior Professor of Pathology in Vienna. I was invited to be present when these gentlemen examined the sections and discussed the nature of the disease. The conclusion they came to was that the disease was a hitherto unknown form of biliary cirrhosis.

In a paper read before you, Dr. Jogendro Nath Ghose has given an able and interesting account of the disease, based upon a very large number of cases. I shall not enter into the consideration of the course and symptoms, but will confine my remarks to the morbid anatomy and pathology. I shall not take up your time by a lengthy description of the appearances presented by the liver, those who are interested in the subject will find a fairly complete account of the morbid anatomy in the article in the Scientific Memoirs previously mentioned, and as to the symptoms and *post-mortem* appearances of my first four cases I must refer you to the proceedings of the Calcutta Medical Society for the years 1888-89, published in the *Indian Medical Gazette*, in which will also be found papers by other members of the Society dealing with the disease.

The last three cases, in which I was able to obtain a *post-mortem* examination and to preserve the livers have never been published; one of them shows the disease in an early stage, and is referred to in my paper in the Scientific Memoirs as No. 5.

Before dealing with the pathology of the disease, I shall give a short description of the principal changes found in the liver and other organs. It is to be noted that none of the other organs exhibited any definite alteration from the normal, except the kidneys, which, in the first four cases, showed marked degeneration and shedding of the epithelium of the tubules; the kidneys of case 5 were perfectly healthy. It is, therefore, probable that these organs are not affected until at a late stage of the disease, when the destruction of the liver-tissue is extreme. The spleen was enlarged in all the cases, but not to any great extent, and presented nothing peculiar when examined microscopically.

On *post-mortem* examination of a child in whom the disease had reached an advanced stage, that is, when the enlarged liver had begun to undergo diminution in size, the following appearances are usually found:—

The body is fairly nourished, marked emaciation is rare, œdema is present in the feet and legs, and generally also in the face and hands, some fluid is usually found in the abdomen, but not more than a few ounces as a rule. The tissues of the body are deeply bile-stained. The liver is larger than normal, though it is smaller than in the earlier stage of the disease. Its shape is normal, anterior edge thin, surface smooth and mapped out by lines like the surface of morocco leather. The capsule is normal and presents no sign of perihepatitis. The substance is tough, fibrous and deeply bile-stained. The cut surface is granular, the lobules are seen to be enclosed in fibrous tissue, which may be so abundant as to completely obscure the hepatic texture.

The gall-bladder contains a small quantity of pale glutinous fluid, having only a slight resemblance to normal bile.

The changes found on microscopical examination are very pronounced; there is an abundance of fully formed fibrous tissue in all parts of the liver. The lobules are seen to be enclosed by bands of fibres, and the liver-cells separated into groups by a well-marked fibrous network. The effect of the latter on the structure of the lobules is very great, the normal radiating arrangement of the liver-cells is completely destroyed, and replaced by networks of the fibres in the spaces of which the liver-cells are lodged. This intercellular development of fibres constitutes one of the peculiar features of the disease.

The changes in the liver-cells are very marked; speaking generally they may be described as almost entirely destroyed. In sections, such as that from which figure 5 in the plate illustrating the paper in the Scientific Memoirs is taken, not a single recognisable cell can be found; all are destroyed and represented by masses of granular debris occupying a small portion of the spaces in the fibrous network. In other sections, cells presenting signs of degeneration of a less advanced type and still possessing the characters of hepatic cells are found. Here and there in a section a few groups of healthy cells are seen. In dealing with the pathology of the disease, I shall have have again to refer to the changes in the hepatic cells.

Among the fibres of the interlobular bands, a large number of bile-ducts are found. They vary in size, some possess distinct walls lined with cubical epithelium, the greater number are minute tubules formed of two rows of cells. These ducts branch and radiate among the fibres in every direction, and some are found within the lobules among the degenerated liver-cells.

The appearances presented by the liver in the earliar stage of the disease, as seen in case 5, are of great interest and importance in tracing the course of the morbid process. This specimen was taken from the body of a Hindu female child, aged 1 year and 3 months, admitted into hospital on the 19th May 1890, died on the 21st of the same month. On admission the temperature was 100° F., and continued to range between this point and 103° F. up to death. There was very slight œdema of the feet, no jaundice. The liver was enormous, and filled the whole of the upper part of the abdomen. It was found to weigh 22ozs., its dimensions are given in the paper in the Scientific Memoirs. It was normal in shape, pale in colour, the surface was smooth and presented a slight degree of mapping out of the lobules. The substance was tougher than normal and granular in appearance. There was a small quantity of pale mucus in the gall-bladder. The spleen was simply enlarged, when examined microscopically the most marked changes were within the lobules. The hepatic cells were everywhere broken up into groups of various sizes, by the presence of bands of loosely arranged fibres exhibiting numerous nuclei and well supplied with capillary blood vessels. The group generally contained five or six liver-cells.

Outside the lobules there were narrow processes of fibrous tissue which proceeded from the portal sheaths. As a rule, they completely separate the lobules from one another, and were altogether absent in many parts of the section, whereas the intercellular network was everywhere present, better developed, and equally distributed throughout every part of the lobules; the conclusion to be drawn from this is, that the development of intercellular fibres occurs independently and previous to the proliferation of the portal sheaths.

The condition of the liver-cells gave evidence of irritation proceeding to degeneration. These effects were found in sections taken from all parts of the liver, and were as well marked in the central as in the peripheral portions of the lobules. Most of the liver-cells appeared normal, in many signs of irritation were present—marked granularity of the protoplasm and multiplication of the nuclei, some were completely destroyed. These changes occurred in whole groups of cells, or in one or more cells of a group, the other cells being healthy or less affected.

In the proliferating tissue of the portal sheaths numerous bile-ducts were visible. These were also found at the periphery of lobules, where no interlobular fibres existed, and were also present within the lobules.

From the above description of the changes found in the livers of these children, it is evident that the disease presents many peculiar features. It will, I think, be acknowledged that it differs from all the forms of cirrhosis of the liver described in European medical literature. It certainly more closely resembles the variety known as biliary cirrhosis, but from this also it differs in so many important features that we are justified in describing it as a form of biliary cirrhosis. As I have before remarked, a more correct name would be intercellular cirrhosis.

For the purpose of tracing the course of the changes, and to determine in what constituent of the liver the morbid process begins, it will be found that No. 5 is of more importance than any of the first four cases. In the latter the disease has so far advanced, and the disorganization of the liver-tissue is so great that the normal appearances are completely destroyed ; and consequently it is impossible, from an examination of these livers alone, to attempt to trace the steps of the disease, but when taken in conjunction with No. 5, they afford much assistance.

From the appearances found in case 5, it is, I think, placed beyond doubt that the liver-cells have been subjected to the action of some substance which induces irritation, leading to degeneration. What this substance may be I do not now attempt to discuss ; its effects are unmistakable. and are clearly shown in sections from all parts of the liver of case 5. In the first four cases, the liver-tissue is almost entirely destroyed ; and as there is an enormous quantity of fibrous tissue present everywhere, the condition of the liver-cells might be attributed to the pressure of the fibres. This explanation, however correct it may be for cirrhosis of the ordinary portal type, does not explain the appearances found in the form of biliary cirrhosis now under discussion, as will appear from a consideration of the following facts. The intercellular fibres are not applied closely around the cells, but form an open network, in which the degenerated cells occupy only a small portion of the spaces ; the destruction has begun in case 5, in which the new formation within the lobules consists of loosely arranged delicate fibres containing many nuclei and supplied with large capillary vessels distended with blood ; the portal sheaths are only slightly involved, and the interlobular bands, where present, are composed of fine fibres, infiltrated with numerous sound cells. Moreover, the destruction of the liver-cells occurs in all parts of the lobules ; and in some groups, healthy and degenerated cells are found side by side. These appearances could not be brought about by the pressure of the newly-developed fibres.

The following explanation appears to account in a satisfactory manner for the changes, and to be proved by evidence derived from an examination of these livers, and also to be supported by the known course of events in other organs and tissues of the body when subjected to long-continued irritation.

The disease is due to the action of an irritant which primarily attacks the liver-cells, inducing the described changes in them. The effects of this irritant are not confined to the liver-cells, its presence in the liver leads to stimulation and proliferation of the connective tissue-elements, with the result that there is produced a network of fibres within the lobules. At a later period, the process of proliferation extends to the portal sheaths and interlobular bands of fibres are formed. That a destructive irritation occurring in the highly specialized elements of an organ may be accompanied by proliferation of the more simple elements is well known and constantly seen in all organs and tissues of the body ; I need only mention the nervous system, in which we find fibrous tissue is formed when the special cells are destroyed ; a similar process is seen in muscle and in other tissues.

Another feature of the disease, and one which I shall endeavour to show to be of the greatest importance, is the multiplication of the bile-ducts. This process appears to begin early ; it is well marked in case 5, though the number of ducts is small, compared with the number seen in sections from the other cases. In the article in the Scientific Memoirs, I have given a detailed description of the bile-ducts and drawn attention to their presence within the lobules among the liver-cells ; I have also shown that the ducts were most numerous in those parts of a section in which the liver-cells were destroyed, and it seemed to me that this fact pointed to the formation of bile-ducts being in proportion to the destruction of the liver-cells. I was unable to offer any explanation of the fact. It is evident from a consideration of the nature of the bile-ducts that we cannot proceed to explain the development of proliferative activity in them as being exactly similar to the formation of fibrous tissue.

Professor Paltauf, after careful examination of specimens of my seven cases, came to the conclusion that the proliferation of the bile-ducts was connected with the reformation of the liver-tissue, and was, therefore, a curative process. In this opinion Professor Kundrat agreed ; and they considered it the most interesting feature of the specimens, as it showed—what had never before been observed—that a regeneration of liver-tissue can occur in the course of a disease. Regeneration of the liver-tissue has been proved to occur in animals subjected to experiment with the view of determining, this point; it has also been shown to follow removal of portions of the human liver for surgical purposes, but until seen in sections of the livers of these children it had not been known to occur in disease.

The process of regeneration, as it occurs in these livers, is on exactly the same lines as those followed in the development of the liver in fœtal life, except that the starting point is the pre-existing bile-ducts. These proliferate, multiply, give off branches from which masses of liver-cells are formed. In my specimens the whole process can be traced without much difficulty, especially in some of the sections, particularly those of case 5 and of my last two cases; in fact, Professor Paltauf, in speaking of one of the latter, said the process has so far advanced that the disease was nearly cured, and he confidently predicted that cases of recovery would be found to be much more frequent than I had represented.

The importance of the process of regeneration lies in the encouragement which it gives us in treating the disease. If what I have described on the authority of two of the greatest pathologists in Europe be correct, we may reasonably look forward to being able to save a considerable percentage of the children affected with this disease. Of course, success can only be expected when the patient is seen early and treated until all signs of the disease have disappeared. No doubt some cases are hopeless from the first. I have known of instances in which the disease ran its course in a few weeks, and in these the destruction of the liver-tissue proceeds with such rapidity that there is no time for regeneration to take place. But in cases of the ordinary type, we can expect by careful treatment to diminish the strain on the liver and to keep the patient alive until regeneration of the degenerated cells has occurred. Of course the principal point to which treatment must be directed is to removing the cause which sets up the destructive process in the liver-cells. In a paper communicated to the Calcutta Medical Society in 1889, I put forward the view that the disease was due to food. I arrived at this conclusion after a careful consideration of all the aspects of the disease had led me to reject all the usual causes of cirrhosis of the liver in adults, alcohol, syphilis and malaria. The first of these may be dismissed at once. Syphilis requires more consideration; but apart from the statements of parents, there are the following facts against it being the cause—in not one of the many cases seen by me and in none of the seven in which I obtained a *post-mortem* examination could I find a single sign of syphilis. Moreover, on putting the question to Professor Paltauf, he declared positively that the disease was not syphilitic.

When we come to discuss malaria as a cause, we are met with the difficulty that malaria is found in all parts of this country. On the other hand, this form of biliary cirrhosis occurs most frequently in large towns where malaria is less intense than in country districts; further, there is a distinct type of malarial liver characterized by enlargement, and the presence of a large quantity of pigment in the liver-cells without any marked signs of degeneration; and if fibrous tissue is present, as occurs in some cases, it takes the form of cirrhosis of the ordinary type.

I see no reason to depart from the view, originally put forward in the paper referred to, that the disease is due to some substance derived from the stomach or intestines. It is probable that, as a consequence of improper food and faulty digestion, substances of an irritant quality are developed, which, when carried to the liver, act on the liver-cells. Physiologists teach that one of the functions of the liver-cells is to remove deleterious substances from the blood. And it is conceivable that in this disease of the liver, the substances may possess such qualities, or be present in such quantities, that they set up irritation and degeneration of the liver-cells and bring about the disease which I have described as *a form of biliary cirrhosis.*

In conclusion, the main facts of the disease may be briefly stated as follows:—

1. It is a disease which prevails among young children in Calcutta, and probably other parts of India.
2. It is essentially and primarily a disease of the liver-cells which undergo irritation and degeneration.
3. The development of fibrous tissue occurs first within the lobules, constituting an intercellular cirrhosis.
4. At a later period, the portal sheaths are affected and interlobular bands are produced.
5. The proliferative activity of the bile-ducts, which results in the formation of numerous new ducts, is a process having for its object the reformation of the destroyed liver-cells, and therefore curative.
6. The cause of the disease is probably some irritant generated in the stomach or intestines as the result of imperfect digestion or improper food.

BILIARY CIRRHOSIS OF CHILDREN.

BY JOGENDRO NATH GHOSE, L. M. S.

UNDER this title, I venture to lay before you some facts connected with what I may call a new disease, which has lately appeared among the children of certain classes in Calcutta and other parts of Lower Bengal. On account of its generally unsuccessful treatment and fatal termination, it has, of late, drawn considerable attention and been the subject of serious thought in the minds of medical practitioners and the general public. I call it a new disease, because it has not yet been treated in any of the current books on practice of medicine. The short descriptions that have appeared in some of the recent medical works of a similar liver complaint are very vague and imperfect, and they do not seem to refer exactly to the particular disease now under discussion. It also escaped the observation of early European practitioners, who, in most subjects, have left behind valuable records of their Indian experience, and until twenty years back it scarcely drew the attention of our old and experienced medical brethren. The literature on the subject of this disease is, therefore, still very meagre.

The peculiar features of the disease are that its onset is insidious; that it usually prevails among infants under the age of one year; that it seldom attacks children after they have passed the third year. The attack generally commences on the seventh or the eighth month, chiefly at the period of dentition or the mother's next conception. The children of some parents are particularly liable to the disease. In one family, I have observed fourteen children of the same parents die one after the other. Cases of attack on the third or fourth month, or even a few days immediately after birth of the child, have also been noted. Children in Calcutta, as well as in the Districts of Bengal, whether malarious or non-malarious, are equally subject to it. It makes no difference between the children of the intemperate, the sober, or the teetotaller. It spares neither rich nor poor, though the well-fed children of the wealthy and middle classes are more liable to it than the ill-fed children of the poorer classes. Muhammadan and Eurasian children suffer less than the Hindus. Hardly any cases are seen among Europeans. Children who were never put, or put for a short time only, to the mother's breast, and fed with cow's, goat's or ass's milk, or with different kinds of artificial food, enjoy no immunity from this disease. In those families where the disease prevailed, I noticed a few children escape apparently from being nourished by healthy wet-nurses. When the disease was first noticed in Calcutta, more cases were found among male than among female children; but of late the proportion seems to be less, and more female children than formerly now come under the notice of practitioners. Still, I point this out as a peculiar feature of the disease. Another peculiarity noticed is that the female children mostly attacked are usually the first-born of the parents who are necessarily the objects of great care in a family.

It has been observed that a female child escapes the malady after the successive deaths of several males that preceded her, though again the next male child succumbs to it. Children of very healthy parents are not exempt, and the disease appears to be quite unconnected with long standing purulent discharges, scrofula, syphilis, malarious fever, or any chronic constitutional disease. In a family of several brothers living in the same house and under exactly the same conditions as regards food, it is rare to find the children of more than one of the brothers affected with the disease. In one family of three brothers living together under the Hindu family system, one brother lost fourteen children, most of whom died about one year old, while the ten children of the other brothers remained quite healthy. This is the rule, but exceptional cases have come under observation in which the children of two brothers living together were affected by the disease; of the children of a brother and a sister living apart being attacked; and of the children of two sisters living in different families having suffered from the disease. It has also been noticed that in some cases the later children of some parents escape the disease after the earlier ones have one and all died of it. The enlargement of the liver is gradual, and is unattended with pain. The subsequent contraction is, however, rapid. The termination is generally fatal, death being mostly due to cholæmia. The disease runs its course from three to twelve months, though one case has been known to end fatally within a fortnight of the attack, and the patients in two other cases, which came under my observation, lingered on for three years, and in these cases change of climate was tried in vain. In my experience, out of about 400 cases only six recovered. The diagnosis in the case of three is, however, open to doubt. Of the remaining three, one child was sent out for change at the very commencement of the disease, and two recovered after the first symptoms had been fully manifested, but in none of these cases was there persistent jaundice, which in my experience is a fatal sign.

In 1877, a few cases came under my observation. All these patients were in the last stage of cholæmia, with contracted liver, ascites and œdema of hands and feet. I took some of these cases for malarious enlargement followed by cirrhosis of the liver. During the next two years, I carefully watched a few more cases. I found the liver hard and resistant to the touch, and the enlargement was great, but accompanied with little or no pain, and slight fever. At the last stage, jaundice set in, the liver gradually contracted, and the little patients died from bile-poisoning. The disease was then supposed to be some form of degenerative liver of children and was called "amyloid, fatty or infantile liver." Since that time I had occasion to notice numerous cases of this kind, and the disease seems to be spreading, not only in Calcutta, but also in the districts, as cases are frequently brought to town for treatment. I consulted several leading and eminent physicians, both European and Indian, but none were able to throw much light on the diagnosis and treatment of this serious malady. Since 1887, a number of cases were brought before the meetings of the Calcutta Medical Society, and papers read and the subject fully discussed, but until recently no definite solution was arrived at regarding the true nature of the disease. Parental objection and caste-prejudice stood in the way of a thorough and extended investigation into the nature of the disease by *post-mortem* examination in well authenticated cases. Medical science, therefore, is indebted to Surgeon-Major J. B. Gibbons, who, as Professor of Pathology in the Medical College, Calcutta, always took an active interest in the disease, and availed himself of the opportunity to hold *post-mortem* examinations in few hospital cases which led to the discovery that the disease is a *form of biliary cirrhosis*, presenting features which distinguish it from diseases of a similar nature described in medical books. Since that time the medical profession has termed it biliary cirrhosis of children. The disease may be defined now as a painless enlargement of the liver, hard and resistant to the feel, beginning with slight fever, occurring in children only and terminating almost invariably in death.

The onset of the disease is so very insidious that, as a rule, nothing is noticed by the parents until the liver has attained a considerable size. To my knowledge, qualified medical men of considerable experience failed to detect the disease at the early stage in cases even of their own children. The early symptoms which attract the mother's notice are nausea, occasional vomiting, sallow complexion, warmth of hands and feet, and a certain amount of constipation with straining at stools. The child also refuses food, gets irritable, loses its cheerfulness, wishes to lie down on damp ground and gets a little fever towards night or early in the morning. Some thirst also is noticed. A slight icteric tinge is also sometimes observed in the eyes.

Enlargement.—When the child is brought under a physician's observation, the liver appears enlarged, at times so considerably that it extends as far as the umbilicus or even beyond it to the iliac crest. The anterior margin of the liver is well defined, prominent at first, and feels smooth and rounded ; gradually it becomes thinner, assuming the shape of a knife-back-edge, and, at the last stage of the disease, it can be grasped by the fingers. The enlargement is uniform, the liver being hard and resistant ; painless first, but slightly painful when jaundice supervenes. The left lobe generally enlarges first, sometimes reaching as far as the spleen, which also in most cases enlarges simultaneously. Occasionally the right lobe enlarges so much that its anterior border overlaps the left lobe and the notch between the lobes is so displaced to the left as to be mistaken for the hilum of the spleen. At this stage the liver goes on enlarging, gradually filling up the abdomen, which bulges out, the superficial veins becoming prominent. As the liver enlarges, the child becomes more markedly ill, with fever, loss of appetite, more pronounced jaundice, accumulation of fluid, etc.

General appearance.—The general appearance of the patient presents no marked change in the early stage of the disease. After a short time the features exhibit a dusky appearance ; later on the skin becomes harsh and dry ; the complexion slightly yellow ; the feet and hands may become puffy : this last symptom usually disappears after a few days, but returns again.

Spleen—is generally hard and enlarged, but not to a considerable extent.

Constipation – is a well-marked obstinate symptom. The stools are yellowish at first, then clayey and muddy, and lastly whitish and devoid of bile.

Urine—at the commencement is clear, but gradually becomes bile-tinged, and lastly deep yellow, saffron-coloured, the stain of which does not disappear on washing. There is no, or very little, perspiration.

Fever—is slight at the beginning, but it increases with the progress of the disease, and the maximum is reached when the jaundice is pronounced. There is no shivering or ague with the fever ; in some cases it remains continuous, while in a few it only appears late with the jaundice.

Ascites.—In some cases a certain amount of fluid accumulates in the peritoneal cavity, with œdema of hands and feet.

Jaundice.—The most important symptom as regards prognosis is the appearance of jaundice. In the early stage, a slight discolouration of the body may occur, but this is not to be confounded with the deep and persistent jaundice which attends the later stage of the disease. At this time the whole body gets discoloured and the conjunctivæ become bile-stained. The onset of the intense and persistent jaundice, which occurs in the later stage of the disease, is a symptom of the gravest import.

Contraction of the liver.—After the appearance of the jaundice, the size of the liver begins to undergo diminution. In a few cases, I have observed the contraction so very rapid that in forty-eight hours it has come up from the umbilicus to the inside of the costal arch. This contraction has often been mistaken for a favourable symptom.

Etiology.—The main cause of this serious malady is, I believe, unwholesome food and faulty digestion. The milk, either of the mother or of the cow, is the principal article of food for our infants. Muhammadans and Eurasians feed their children occasionally with animal broth. The Hindu mother always nourishes her children from her own breast, and it is among the Hindus that the disease is most prevalent.

First, as regards the mother's milk.—The practice is not uncommon for a mother in a state of pregnancy to suckle her child. Her system must then be undergoing a change, rendering her milk quite unfit for the child in arms. The double strain to which she is subjected may also contribute to a further deterioration of the nourishment she can afford at this time. Indeed numerous cases have been noticed of children being attacked with the disease immediately after her next pregnancy, specially in cases when the children of the same parents died one after the other of this malady. In the case of one family in which fourteen children successively died of this disease, I was able to clearly establish this point. The mother usually became pregnant from six to twelve months after each delivery, but still continued to suckle. Within a short time, the signs of the disease used to appear in the suckling child. As I have noticed this fact in many other cases, I am inclined to attach very great importance to it as one of the potent causes of the disease. I am also of opinion that the Bengali race, specially the females of the middle and the richer classes, are gradually undergoing degeneration, and getting indolent, dyspeptic and enfeebled by early marriage and premature and frequent pregnancies. All circumstances which tend to lower the mother's health equally tell against the health of the children born of her. A healthy child cannot be expected from an unhealthy mother.

Second, as regards cow's milk.—This, the next best diet of our infants, is so much adulterated in large centres of population that it may be pronounced as quite unsuitable for infant food. Besides adulteration of the milk, the cows are kept in sheds, and fed on refuse and other unwholesome food-substances. Great carelessness also prevails in the matter of keeping the milk. The vessels are not properly cleaned, and stale milk is often sold as fresh. In feeding the child with cow's milk, even the parents themselves do not take sufficient care as regards the quality of the substance used. Stale milk is given to the child late at night or early in the morning, and the unsuitability of the milk due to a difference in the age of the calf and that of the child is never taken into consideration.

Irregularity in feeding and over-feeding.—No regularity is observed in feeding the child. Whenever it cries or gets cross, in order to pacify it, a certain amount of milk is poured down its throat, Male children, who are generally the objects of great solicitude in a Hindu household, are over-fed with pure cow's milk, under the impression that it would make them robust and healthy, and, as stated before, the disease is more prevalent among males.

The primary cause of the disease may, therefore, be safely stated as mal-assimilation.

Predisposition.— There also appears to be a predisposition in many cases. This predisposition seems to be inherited, as is proved by cases in which the children get the disease only a few days after birth ; by successive deaths of a number of children in the same family, in spite of all the precautions taken under the best medical advice ; and by its occurrence among children of uterine brothers and sisters.

In support of the above arguments, I will now cite only a few of the numerous cases that came under my immediate observation :—

(1) *A*, present age 52, has been the father of eighteen children by the same wife, all dead. Of the first four the cause of death is uncertain, and the next three are supposed to have died of biliary cirrhosis, but I cannot be positive about them. I can, however, certify that the remaining eleven died of biliary cirrhosis.

Neither among the father's nor the mother's relations have any of the children shewn the disease. The wife's father is dead but her mother is living. The wife enjoyed good health until recently, when she began to suffer from dyspepsia. She was married at the age of 11, and her first child was born when she was 13. She had altogether eighteen children, no miscarriage. The children were born at intervals of 15 to 24 months, and lived to the average age of 12 months ; only one child reached the age of 2½ years. Neither *A* nor his wife ever suffered from syphilis, scrofula, or rickets. I saw the last fourteen children and am positive that eleven of them died of biliary cirrhosis. Some of these succumbed shortly after the disease appeared; others lingered for a year or more. The average duration of the disease was about six months. Death as a rule occurred with well-marked signs of cholæmia, after the contraction of the enlarged liver had begun.

(2) The history of another family illustrates well some of the peculiar features of the disease. *B*, a qualified medical man, resident of Calcutta, some years ago left his wife and family in his village home in a malarious district. His wife had altogether thirteen conceptions. Numbers 1 and 2 miscarried; 3 and 4 still-born; fifth, a female child, died of fever with enlarged liver and jaundice. This occurred some years ago before the subject of infantile liver attracted attention, and the death was attributed to malaria. Nos. 6 and 7, twins, both males : one died immediately after birth ; the other got enlarged liver with jaundice and was removed to Calcutta for treatment, where the family have lived ever since. The disease of the child was now diagnosed as infantile liver ; it died on the fifteenth month. The eighth child, a daughter, was born in Calcutta, and was nourished by the mother : she is healthy, now married. The ninth was a son, nourished by the mother, who died of biliary cirrhosis, though the disease was recognized early and every effort made to save him, including change of climate. The tenth child, also a boy, was never given the mother's breast but was suckled by a healthy relative, who happened to have been delivered at the time and who had sufficient nourishment for both children. This boy is living and quite healthy. About two years after the birth of this boy, the eleventh child, another boy, was born. He was suckled by the mother and is also healthy. One daughter (12th) was subsequently born and has lived. The thirteenth was still-born and the fourteenth, a daughter, is living and healthy. Not taking into account the miscarriages and the still-born, out of a family of nine children, three died, two certainly from biliary cirrhosis, the other probably from the same cause. As to the history of the parents, the father *B* is not a very strong man, though never ill. At one time he had some enlarged glands on the neck which suppurated. But he suffered from no other disease. The mother is a healthy, robust woman. The father had two brothers ; one had three children, of whom one son died of biliary cirrhosis.

(3) The following case is, I think, of importance :— *C* has been married three times By the first wife there was one child, healthy; by the second wife there was one child, also healthy; by the third wife he had three children, all of whom died of biliary cirrhosis. *C* is healthy, and his third wife is healthy too, though not very robust.

D, an assistant surgeon, was married thrice. By his first wife he had one son and one daughter ; both healthy. His second wife was childless. By his third wife he had six children : first two females, all healthy. The third, a son, being the first male, was given from birth undiluted cow's milk in addition to mother's nourishment. The mother was a healthy woman and had plenty of milk. This child died of biliary cirrhosis. The others are healthy.

(5) Let me cite one more instance. *E* has two wives, both have children. First wife's only child died of biliary cirrhosis. Second wife's children died from other causes. No child alive.

Many instances may be mentioned of the disease having attacked the children of only one wife of the same husband, while those of the others having enjoyed a perfect immunity from it.

It is difficult to diagnose the disease at its early stage. But once the first symptoms are developed, the generally uniform, painless enlargement of the liver, which is firm and resistant, leaves no doubt as to the nature of the disease. The enlargement becomes enormous and subsequently contraction ensues with the usual symptoms mentioned before. It may be stated here that the little patient can be best examined when it is asleep. The disease may be mistaken for amyloid liver, but the latter is very rare in this country, and its causes as a rule are absent. The enlargement and the progress of the disease, however, soon clear away the doubt. From enlargement of the liver connected with malaria it may be distinguished by its occurrence among children removed from ordinary malarious conditions. It is especially the disease of large towns like Calcutta, and is easily distinguished by the absence of features which form the principal characteristics of malarious fever. The points which differentiate biliary cirrhosis from other liver disease of a similar nature are given by me in detail in the comparative tables published in the report of the proceedings of the Calcutta Medical Society for December 1890.

Duration.—As said before, the attack generally takes place when the child is less than a year old. The duration of the disease is from three to nine months, death generally occurring from fifteenth to the eighteenth month. In exceptional cases which came under my observation, death on the one hand occurred within a couple of weeks, while on the other hand the patient lingered on for three years.

Prognosis.—The prognosis is extremely unfavourable and gloomy. In my experience, out of about 400 cases, only six recovered but in three of these the diagnosis is open to doubt.

Morbid Anatomy and Pathology.—For an account of morbid anatomy and pathology of the disease, I would refer you to the article written by Dr. J. B. Gibbons in the " Scientific Memoirs," Part VI, and to the papers which he read before the Calcutta Medical Society,

Treatment.—Hitherto the results of treatment have been very unfavourable, even with cases which have been under observation from the early stage. I believe these unfortunate results are mainly to be ascribed to the difficulty which exists in having any line of treatment carried out in its entirety. I refer specially to the difficulty in the matter of food. I place the most reliance in a complete change of diet, holding that the disease is mainly due to unwholesome food. Much difficulty is experienced in getting the parents to carry out the instructions in this matter. When a case occurs in a suckling child, the first instruction given is that the mother should at once stop giving her breast to the child and to feed it with some other food. This is seldom carried out. The reasons for this are obvious : the child accustomed to suckle naturally shows a reluctance to take to any other food, and the mother hearing its cries gives way and suckles it, notwithstanding all instructions to the contrary. This is specially the case at night, when the child lies alongside its mother.

As said before, the treatment which I now adopt and which appears to offer the best hope of success is mainly dietary. When I see a case, I enquire as to the food given to the child, and generally make a complete change in this. I always forbid the mother's nourishment and substitute in the case of young infants a healthy wet-nurse, if available, or, if not, a specified quantity of pure cow's milk diluted with water, in proportion to the age of the child, and sweetened with sugar.

When I first saw cases of this disease, I tried different kinds of food.

I may say that I believe I tried every kind of food. But as I have remarked, the directions about diet were seldom carried out by the parents for more than a few days, so that the want of success is not to be attributed to the line of treatment adopted in the matter of food but rather to the failure in carrying out the instructions.

Therapeutical medicines have been tried with the view of combating the morbid process going on in the liver, and for this purpose mercury, iodide of potash, hydrochlorate of ammonia, phosphate of soda, etc., have been used in all forms, but I cannot attribute any benefit to them.

To combat the obstinate constipation, which is a marked feature of the disease, laxatives and cholagogue purgatives have been used. My experience is that in the early stage no great difficulty is met with in keeping the bowels open, and any simple purgative acts very well at this time. But as the disease advances, it will be found that the purgatives used lose their effect and have to be given in increasingly large doses. This constipation is one of the difficulties which the physician has to overcome. Of late, I have been using the freshly prepared juice of the leaves of *Nyctanthes Arbortristis* or the *Siuli* flower tree, in tea-spoonful doses taken in early morning, and this has usually acted well, though when the stage of marked jaundice is reached, it, like every other drug, appears to be powerless.

External applications over the liver, such as blisters, mercurial ointments, and iodine have been tried, as also nitro-muriatic acid, packs, etc. None of these seem to have any influence on the progress of the disease, though at times no doubt they may be useful.

Change of climate is undoubtedly beneficial in the early stage, but later has no effect. Its influence is probably due to the improvement in general health. On the whole, I have found that when the disease has reached the stage of persistent jaundice and contraction of the enlarged liver little benefit can be hoped for. It is in the early stage that the change of food and improvement in general hygiene can be expected to lead to recovery.

BILIARY CIRRHOSIS.

BY NIL RATAN SIRCAR.

This disease is characterized by enlargement of the liver following disorders of digestion, attended with more or less febrile symptoms. At first the food appears to disagree with the stomach, thus causing vomiting, flatulence, constipation, or diarrhœa with very often green stools. The liver soon becomes tender and enlarged, slightly at first, but increasing steadily and getting more and more hardened by day. At this stage the bowels are almost always constipated, the stools being deficient in bile and perfectly clay-coloured. Fever, though slight, persists throughout the course of the disease, there being usually a morning rise and an evening fall. Gradually the little patient loses flesh. Later on the liver contracts slightly, but never very much. Jaundice sets in, sometimes intense dropsy makes its appearance in the shape of œdema of the legs and ascites, and the child dies. About 95 per cent. of those who suffer from this disease die of it before completing their second year.

A curative treatment of this obstinate disease, when it is once established in the system, is likely to be as futile as a preventive treatment is likely to be successful. From what we know as regards the nature of the disease, thanks to the researches of Dr. Gibbons, we may safely conclude that, though a recovery is not altogether impossible, yet it is very difficult to bring it about. The hepatic cells, when once atrophied or destroyed by the pressure of the proliferating bile channels, may regenerate under exceptionally favourable circumstances, but it is not easy to secure this end. Till now, therefore, the chief aim of treatment has been to palliate symptoms and to arrest any further injury to the liver cells. Accordingly, for the last fifteen years, three classes of medicines have been extensively used in the disease—*viz.*, cholagogues, laxative and febrifuge articles—with what result we shall presently proceed to see.

Quinine—As the disease is attended with febrile symptoms throughout its course, and that in a malarious country quinine has been naturally extensively tried in order to prevent as well as to cure it, but with only one result, *viz.*, that it has helped us to come to the one definite conclusion, that the disease does not owe its origin directly to malaria, I have tried it in the very early stages as well as in the later stages, but with no success whatever. In some cases it brings down the temperature for a short time only, after which it invariably goes up again. In others it brings in vomiting, diarrhœa and other symptoms of gastric intestinal irritation. In all it fails to cut off the slow morning fever. I have tried it in nearly two huudred cases, but with no other benefit except a little temporary reduction of temperature.

Arsenic.—After quinine comes arsenic as the next best febrifuge. I have tried it in the liquid form in fairly big doses. But it has altogether failed to hold its own against the slow fever of infantile liver, affording further proof of the non-malarious nature of the disease. In most cases it is easily tolerated.

Cinchona bark.—Cinchona bark, in the shape of the tincture of bark, is a favorite remedy with many of our eminent practitioners. But the result of treatment with it is equally unsuccessful.

Salicine.—These having failed, we have occasion to have resort to salicine as a febrifuge. It has been largely used, I may say, almost in every case in the tea gardens, but with very doubtful results. Some of our best practitioners hold that it is somewhat efficacious, but I have not witnessed it faring better than quinine, so far as the fever is concerned. It however produces no unpleasant symptoms.

Thus there is no hope of cutting off the fever by drugging. The temperature may be kept only under control by diaphoretic and diuretic medicines, a whole host of which, *viz.*, acetate of ammonia, nitrum ether, nitrate acid, nitrate of potash, salicylate of soda, vinum antimoniæ and James' powder, etc., have been used as palliatives with the usual unsuccessful result. The more active modern diaphoretic, *viz.*, antepyrin, antefebrin and phenacetin are seldom called for.

The next class of medicine that are used are the cholagogues. They have a very salutary effect upon the liver tissue, when used judiciously, helping to depurate the liver and promoting the regeneration of the liver cells.

Ipecacuanha.—The best of the lot is ipecacuanha whose efficacy in all the stages, but particularly in the early stage, is undeniable. The ordinary ipecacuanha acid soda powder is held by many to be almost a preventive to this disease. Under its use the stools regain their natural colour in the early stage, the bile is secreted profusely, the bowels become regulated, the skin performs its proper functions, thus reducing the febrile symptom and the child improves steadily. In the later stages, however, it is useless.

Chloride of ammonia.—This medicine is used in combination with laxatives to promote a healthy secretion of the liver. It is also given with nitro-muriatic acid for the same purpose. But however efficacious it may be in other kinds of enlargement of the liver, its value is questionable in infantile liver.

Nitro-muriatic Acid—Is used both internally and externally for the purpose of depurating the liver. It has not answered very well in this disease when it has been used internally. When used externally, however, its value is unquestionable, and a profuse flow of bile invariably follows the administration of hot fomentation with diluted nitro-muriatic acid. This is, indeed, one of our best local applications.

Mercury—Has been used in these cases usually in two forms, *viz.*, hydrag. cum creta and hydrarg. subchlor. These preparations regulate the bowels and cause a healthy secretion of bile for the time being; but no permanent good can be expected from them, or any other preparation of mercury.

Benzoate of Soda.—This salt is a valuable remedy, especially when the attending fever is high or when there is jaundice. It is most efficaciously combined with salicylate of soda or chloride of ammonium. But, as usual, though a very efficacious remedy for the time being, no permanent good can be expected from it. In the later stage, however, it is the best medicine for the jaundice that invariably accompanies this disease.

Antimony—Has been extensively used, but with no success. Some vegetable cholagogues, as taraxacum, euonymin, podophyllin, kalmuga, etc., have been used with very good effect during the early stage. Under their influences the constipation is relieved and the stools assume a healthy colour. But as the disease progresses they become more and more useless, and they have seldom any effect in the later stages. Laxatives, as rhubarb, phosphate of soda, magnesia, castor oil, sodæ bicarb., cascara sagrada, glycirrhiza, etc., have been used extensively to help the bowels to act. They are almost indispensable. Most of these fail ultimately. Besides they can do no permanent good, unless in the very early stage.

Alterative medicines are used from time to time, but with no better result. Seven or eight years ago, when the natural history of the disease was completely in the dark, we would rely upon iodide, iodide of potassium, mercury, &c. But now most of them have been tried and found wanting. Potassium iodide, however, is still used with beneficial effect upon the bile-duct. Calcium salts, and particularly calcium chloride, has been used, but with very doubtful results.

Amongst the external application may be mentioned linseed poultices, liniment of iodine, blistering with red iodide of mercury ointment and fomentation with diluted nitro-muriatic acid. Of these the last is a very good measure, and when taken assiduously cause a healthy secretion of bile, and a reduction of the size of liver in some time. The best counter-irritant, however, is the ointment of red iodide of mercury. But small blisters of this substance are applied successively over the hepatic region, and a most marked reduction in the size of the liver is the usual result. They are applicable even in the advanced stages when the liver is hard.

We now come to the most important department of the treatment of this disease, *viz.*, that of dietary. A proper selection of the articles of diet would prevent the disease in many cases, and would arrest it in others. I need hardly say that I have no sympathy with those who hold that starvation is the best dietetic treatment for infantile liver. On the other hand, a sufficient supply of food is absolutely necessary for the growing frame of infants, and particularly at the time of dentition. At the same time we ought to remember the origin of this disease lies presumably in some disturbance of digestion caused by ingestion of unhealthy articles of diet. And the large prevalence of the disease in Calcutta is due partly to the supply of bad milk in this town. The ideal baby's food, *viz.*, good mothers' milk, is, speaking generally, not always available in Calcutta. The particular defect in the milk that helps to bring about the catarrhal condition of the stomach and the duodenum leading into irritation and subsequent inflammation and proliferation of the bile channels— it will take a long time to make out. That there exists such a defect is borne out by presumptive evidence. Thus I have on my records three ladies, in one of whom all the children who were fed upon breast milk died of enlarged liver; whereas in the two others, though the elder children, fed upon breast milk, died of the same disease, the younger ones, who were put upon artificial food soon after their birth, have grown with little trouble to fairly healthy childhood. We thus find that it is sometimes necessary to stop mothers' milk to unfortunate babies in the city. So long as we are not in a position to determine the exact deviation from the normal standard of milk in such cases, we shall not be able to make up the defect, nor do we know the cases in whom we should stop the milk, unless by previous bitter experience. This makes our position extremely difficult.

As a rule, however, we are quite justified in assuming that mothers' milk, even in Calcutta, is the health diet for the infant, unless the contrary is proved; and then we may cut it off in particular cases.

Cows' milk.—For such infants, and for those for whom mothers' milk is insufficient, cows' milk is the article almost universally used in Calcutta. This article, as obtained from our milk vendors, is not a very innocent thing for the baby's stomach. There are indeed few infants who do not suffer from disorder of the stomach, liver, and bowels, while feeding exclusively upon it. Constipation, diarrhœa, acid vomiting, flatulence, green stools are the ordinary results of feeding babies exclusively upon unmixed cows' milk in Calcutta, while enterocolitis is not rare.

Hence a change of diet is often necessary. The services of wet-nurses are not available here. Hence our choice falls between milk of some other cattle and cows' milk corrected and modified by the addition of some malted preparation. When given in this way, cows' milk is an innocent yet very nourishing article of diet. Its chief probable defect, namely, being curdled in thick solid masses, appears to be removed. I have put some infants upon cows' milk and Savory and Moore's food from the date of their birth, and they are all doing very well. As milk modified in this way is very easily digestible, it favours a very suitable article of diet for infants with or without enlargement of the liver.

As the cows' milk available in Calcutta is not at all good, we are sometimes compelled to have recourse to some preserved milk. I have often given unsweetened Swiss milk combined with Savory and Moore's food or Mellin's food to very young babies with liver complaints with very good result. I have never found it doing any harm. Ass's milk is a very good article of diet for the children of those who can afford to pay for it. It is very easily assmilated and also acts as a laxative. Liver enlargement is rare in infants regularly fed with ass's milk. Its only defect is that it turns sour within a short time and also its natural acid reaction. These may be remedied by giving it combined with a little sodæ bicarb. to the infant not too long after milking. In confirmed cases of infantile liver this milk is the article of diet.

Goats' milk is another good article of diet for infants. It has one superiority over all other kinds of milk, *viz.*, that this curdles in the stomach in very fine flakes and therefore very easily digested. The constipation following its rise is due to a large portion of it being absorbed by the system and therefore quite harmless. I have given it to infants with enlarged liver in combination with Mellin's or Savory and Moore's food. Thus used it is not constipating at all. Thus I have found that next to mothers' milk ass's milk is the best article of diet for infants ; and goats' milk, healthy cows' milk and unsweetened Swiss milk rank next, whereas the cows' milk of the Calcutta bazaars rank lowest. The dietetic proportion of these articles are considerably improved by combination with some of the malted preparations. On this principle I have invariably prescribed the diet of infants labouring under enlarged liver and often with very desirable result. In many cases where the disease was in its early stage, it has been arrested ; in confirmed cases considerable improvement has followed the alteration of diet on these lines.

Next to milk and the malted foods comes soup as an article of diet for infants. There is no question about the good done to babies by jugged chicken. It may be given freely to suffering persons without fear. Puncturing the liver with long needles has been recommended, but I have no experience of it, and I cannot pronounce any opinion either for or against the measure.

Last of all comes the important question of change of climate. This disease is more frequent in Calcutta than anywhere else. Whether it depends for its origin upon the bad milk-supply of Calcutta, or upon the bad climate of the place, is still an open question ; but a change to a better climate often does a world of good to the little patient. I have on my records about a dozen cases in whom a change—Madhipor or Badyanath—at a very early stage of the disease has completely irradicated the disease from the system. The improvement is generally steady from the date of removal to such a place. I also sent two cases to Darjeeling ; and the result of the change was highly satisfactory. In them the slow fever began to abate from the date of arrival to the place, and it ceased altogether in a week's time. The enlargement of the liver which was considerable (the margin of the right lobe being felt about three inches beyond the costal arch in one of them) disappeared in about a month's time.

Whether such good results depend upon the change of climate, or upon the change of diet that necessarily accompanies it, is a question that cannot be answered now.

DISCUSSION.

S. P. Sarbadhikari (Calcutta) thought that the efficacy of the mango fruit treatment of Dr. Rakhal Dass Ghosh's case lay in the fact that terebene abounds in the fruit. Its action is alterative and exercises on the acid secretions of the stomach much the same effects as those produced on the mucous membrane of the lungs in chronic bronchitis and fibroid phthisis.

Rakhal Dass Ghosh (Calcutta) remarked that in the case of his son ripe mango was given at first simply as a food and with no idea of its medicinal value.

He drew attention to the presence of clayey or whitish stools as the first sign of the disease. Removal of the child to good hygienic surroundings and careful attention to diet are imperative, if the disease is at all advanced. Active treatment is useless.

L. Rogers (Punjaub) thought that from a pathological point of view the disease was a rather slower form of acute yellow atrophy of the liver. The process seemed to be one of primary degeneration of the hepatic cells, with subsequent development of fibrous tissue round the bile-ducts.

S. Mohan Dass (Calcutta) drew attention to the incidence of the disease. From the Health Officer's (Calcutta) report in 1891 it appeared there were 521 deaths from liver diseases. Of these 486 were Hindus and 21 Mahomedans. In 1892 there were 593 deaths from the same cause, 546 being Hindus and 30 Mahomedans ; while in 1893 there were 634 deaths, of which 584 were Hindus and 29 Mahomedans. At the same time the ratio between the two classes of population was not markedly disproportionate. As regards food as a factor in the production of infantile liver, the age proportion of death from liver diseases was noteworthy. In 1891, of the 521 deaths in Calcutta from liver diseases 327 occurred in the period of one to five years ; in 1892, of 593 deaths 387 occurred in the first quinquennium : in 1893, out of 634 deaths 385 occurred in the same period. Except among the poorer classes milk is the staple article of diet of this quinquennium. On the absence of definite information, the quality of the milk obtained by the unnatural process of " blowing " cows[*] might be open to serious question.

G. C. Nandi remarked that, accepting the pathology of the disease, the inference was to keep the children's bowels free from irritants. He found soda and salisin most useful for this object. As to the regeneration of destroyed cells, he was unable to believe it possible, since the connective tissue already formed must inevitably contract.

V. Vurdapah Naidu (Madras) said that infantile biliary cirrhosis was common in Madras. He had seen three children of one mother successively succumb to the disease. The first child was born when the mother was eleven and the third when she was fifteen years old.

Hemachandra Sen (Calcutta) remarked that this disease was frequently noticed in children whose mothers suffered from dyspepsia and general ill-health. This condition of the mothers is produced by frequent child-bearing when quite immature, combined with the indolent habits of the better classes.

He insisted on the need of good hygienic surroundings, regular exercise, and regular feeding.

U. Banerjee (Calcutta) considered that the real cause of the disease was still obscure. Bad hygienic surroundings, lazy habits, improper feeding were only predisposing causes. The same kind of milk was supplied to communities among whom the disease was rare. He had seen nine children in one family die of this disease one after another.

N. Dass (Calcutta) agreed with the previous speaker that the real cause of the disease was still obscure. He did not agree with a previous speaker that the disease was a form of acute yellow atrophy. The physical signs, particularly those of enlargement, were quite different, and the duration of the disease much more chronic. Microscopically the appearances were not similar, notably on the occurrence of pigment.

The President remarked that he had seen a few cases in Bombay where it does not seem to be so prevalent as in Calcutta. The disease doubtless occurred all over India, but some localities were affected more than others, *e.g.*, Canara, Calcutta.

He had not had an opportunity of making *post-mortem* examination. He suggested a possible microbic origin from the food. Bacteriological and chemical examination of the fæces and urine was needed.

INFANTILE SCURVY IN CALCUTTA.

READ BY PRANDHAN BOSE, M. B.

It is generally believed that scurvy is a disease peculiar to adult life, and that children, especially of the well-to-do classes, enjoy an immunity from it. I shared in this belief, till four years ago when a case came under my observation, which, for the first time, excited the suspicion that it might exist amongst Bengalee children, though the symptoms may not, at first sight, lead us to a clear perception of its identity. Since then I have been able to gather facts which leave no doubt in my mind that the disease is more common amongst Bengalee children in Calcutta than we are

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[*See paper on " Dairy Produce,' by Surgeon-Captain O'Gorman, in the Public Health Section.—Ed.]

aware of. I will read notes of three cases which I consider best calculated to establish my position. The treatment adopted, having been essentially the same in all the three cases, will be mentioned briefly at the end.

My first case was that of a male infant, aged ten months, who had just cut four of its incisors, and had been suffering from remittent fever and diarrhœa. He was born of perfectly healthy and well-to-do parents, without any history of syphilis or scurvy on either side. He was being treated at the time with diaphoretics and astringents, but was allowed only a small quantity of milk, the deficit being supplemented with barley and water. I should mention that the child was a good feeder while in health, and was unusually large for its age. The fever subsided after a week, but the diarrhœa persisted. It was at this stage that the child came under my observation. I then found that the child's muscular movements were reduced to a minimum, and that it hardly moved its lower limbs at all. It would lie listless for hours together, moaning, and evincing the utmost reluctance to being handled. After consultation with another medical man, we both came to the conclusion—erroneous as the sequel proved it to be—that the case was one of anterior polio-myelitis, and recommended the usual treatment in such cases, insisting strongly on the necessity of a more generous supply of fresh milk. Unfortunately the diarrhœa persisted, and the child continued to be fed on barley gruel, in spite of our remonstrances against it. He resisted this injurious dietary for some time more, at the end of which the true nature of the disease revealed itself in extensive ulceration of the gums and the appearance of hæmorrhagic spots on both legs. Blood was also observed in the evacuations. Rapid emaciation followed, and symptoms of rickets manifested themselves. The lower ends of both tibiæ became swollen, and the epiphyses separated from the shaft after some time. From this period till the age of nearly two years, the child's life was one of alternate deterioration and improvement, and it was only by the adoption of a most careful dietary that all traces of scurvy were finally removed from his system.

My second case was that of a male child, aged about eighteen months, who had cut nearly all his temporary teeth, and had learned to walk. His father, a medical man, being absent on duty, and his mother being in confinement, he was left entirely in the hands of a nurse—an unscrupulous woman who was utterly unfit for the charge. It was afterwards found that she was in the habit of drinking most of the child's milk and of adding water to it to escape detection. When first called to see the child, I was told that he was suffering from infantile paralysis, and was being treated for it. On examination, I found the child able to stand, but the effort was evidently painful, the muscles (especially of the lower extremities) were flabby, and the skin had a rough, oldish appearance. On close examination purpuric spots were found on different parts of the body. The temperature was 100° F., and the child cried whenever an attempt was made to lift him from his bed. His breath was very foul, and there was extensive ulceration of the gums, which were hanging loosely in several places. I at once transferred the child to the care of a kind-hearted and intelligent lady of the family, under whose supervision, and with the aid of a generous diet, the child was restored to its usual health in less than two months.

My third case is still under my treatment. It is that of a female child, aged thirteen months, who has been deprived of her natural food, owing to the mother being the subject of pernicious anæmia since she was brought to bed. As in the preceding case, the child was left to the tender mercies of an ignorant nurse till the age of ten months, when she had an attack of strong fever with bronchitis. In the course of a week she was found to lie all day in bed, with hardly any power to move its limbs. It was at this stage that I first saw her suffering from most of the symptoms detailed above. The lower limbs were flaccid and painful to the touch ; the shaft of the right femur and the lower ends of the tibiæ and radii were swollen. The temperature varied between 102° and 100° ; petechiæ were found in several parts of the body, and the characteristic ulceration of the gums was largely present. An alterative was at once ordered in the diet of the child, and she is now in a fair way to recovery under the immediate supervision of her mother.

The treatment adopted in each of these cases was essentially the same. The child was fed only on fresh cow's milk, peptonising it whenever digestion was found to be deficient. The juice of fresh fruits, especially orange and pine-apple, was given three to four times a day. Later on Scott's emulsion of cod liver oil with Parrish's chemical food was given with great advantage. The condition of the gums was rectified by close attention to cleanliness and by the application of boro-glyceride with glycerine. I ought to mention that the ulceration, as also the petechiæ, disappeared in each case after the child had taken orange and pine-apple juice for only a fortnight. Due attention was paid to the child's clothing, and it was daily taken into the fresh air as soon as it was found strong enough for it.

That the disease in each of these cases was scurvy, a few words will suffice to prove. The ulcerated condition of the gums and the presence of hæmorrhagic spots in different parts of the body distinctly point to changes in the blood, which can be induced by no other pathological condition known to us. The swellings of the long bones may, indeed, raise in our minds a suspicion of rickets, but these appeared long after the other two characteristic symptoms had manifested themselves, and might, therefore, be dismissed as secondary results. Rickets, as we all know, is a disease usually associated with poverty and hereditary syphilis, but in none of my cases was either of these causes at work. Nor has it ever developed with such rapidity as in the instances I have quoted. But what I believe to be the surest proof of all was the rapidity with which the scorbutic symptoms disappeared after the administration of orange juice and other fresh fruits.

DISCUSSION.

Moses (Calcutta) said that among natives scurvy was due to prolonged nursing, while among Anglo-Indians and Europeans artificial feeding was the common cause. A modified condition was very frequently present, such as tenderness of bones, thickening of the heads of long bones, etc. In many cases, a scrofulous family taint was often present. The disease was more common among children brought up by hand, especially those who are fed on artificial foods with practically no milk. Antiscorbutic fruits in this country were at times not easily procurable, it was often difficult to get children to swallow the juice.

P. S. Sen (Calcutta) remarked that though Bengali mothers, as a rule, nurse their children, they are often careless regarding the nature of food given during sickness. Scurvy often occurred as an intercurrent malady in cases of infantile illness, and was often marked by the symptoms of the original disease. Sick children often suffered more from the effects of bad feeding during illness than from the disease itself.

The President observed that the prevalence of infantile scurvy was much more common in India than was usually credited. It was present either as a main cause of ill-health, or as an attendant condition in other diseases. Tenderness of the bones, anæmia, and feeble health are frequently the only symptoms of a mild scorbutic condition. In any cases in which such symptoms occurred, with or without others superadded, antiscorbutic treatment should be at once commenced.

MALARIAL INFLUENCE IN ABORTION AND STERILITY.

BY ARTHUR JOHN WEATHERLY, M.R.C.S., L.R.C.P.,

Kurseong.

From my experience in Africa, Florida and India, I do not think sufficient stress is laid on the malarial influence in abortion and sterility. In my practice I have had the following cases :—

	Confinements at term.	Abortions.
England	56	2
Healthy parts of South Africa where malaria is unknown	35	2
Unhealthy parts of Africa	40	20
Florida	30	22
India	60	28

And a large proportion of these cases, though living in malarious districts, did not abort at times of an attack of fever, and in fact in very many cases malaria only showed itself in the habit of abortion.

I have also noted that a very much larger proportion of women are sterile in malarial districts than in others, and that if they reside many years this sterility becomes permanent, whereas, if they leave before too long a time has elapsed, they bear children.

Of course, in this latter class I do not include those who, miscarrying in malarial districts, bear children in non-malarial climates. Perhaps, as this paper has to be short, the quoting of two typical cases will be sufficient. I would like the experience of others in malarial districts on this subject as I think its importance is not sufficiently impressed.

Mrs. G. had frequent miscarriages in the plains. She was constantly in malarious districts. She was treated by various surgical and medical measures, including scraping out the uterus both in India and London. On her return to a malarious district however she invariably miscarried—generally in the third month. I saw her early in her fifteenth pregnancy (after ten following miscarriages in the plains), and advised her to come at once to the hills and stop there, giving her a tonic of the citrate of iron, quinine and strychnine and enjoining strict recumbency for ten days at a time when her period would have been due if not pregnant.

She went safely to term.

Mrs. H. had lived for years in a malarious district and had never been pregnant. The first year on coming permanently to the hills both husband and wife suffered much from fever, but in the second year both were in good health, and Mrs. H. became pregnant and went safely to term.

These are only two instances of very many.

The influence of malaria on abortion and temporary sterility is still more marked in the very deadly malarious climate of Florida where I saw 22 cases of abortion to 30 confinements at term, and 10 cases of temporary or permanent sterility in a period of two years in a very small district.

In a malarious strip of coast country in East South Africa sheep and cattle constantly abort, and in fact the natives have recognised this so well that they keep their breeding stock in land and only send their stock into this strip of country to fatten. In this country there were no Europeans, but abortions were frequent among the native women, though I could get no figures as to the proportion.

A large number of women who have been in malarious countries, even if they do not abort, suffer very much more when pregnant at the times when their period would have come on than is common with women who have not been in a malarious country and require very strict precautions as to recumbency, etc., at such times.

In such cases I have found that giving quinine rather than tending to bring about abortions certainly tends to ward it off.

Though my experience has extended not very many years it embraces malaria in very different climates, but in all with the same effect in bringing about abortions and sterility and proves a danger in the former case, which I think is not sufficiently recognised and guarded against.

A SIMPLE METHOD OF REPOSITION OF THE PROLAPSED FUNIS.

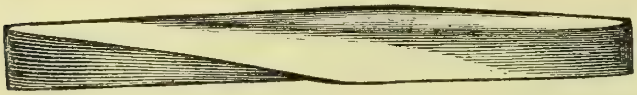
BY KEDAR NATH DASS, M.B.

Various ingenious instruments have, from time to time, been invented for the reposition of the prolapsed funis, and the simplest method has always been of the greatest use. The excellent devices of Roberton, Michael Braun and others are universally known. The following method which has been in use in the Eden Hospital for some years past will be found to serve its purpose admirably.

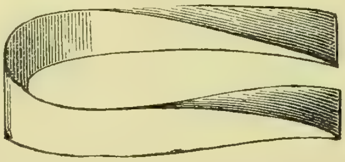
During his incumbency as Obstetric Physician and Surgeon to the Eden Hospital, Dr. Harvey for the first time introduced its use in that institution, and it has been in use there since.

The contrivance can be made in the following way :—

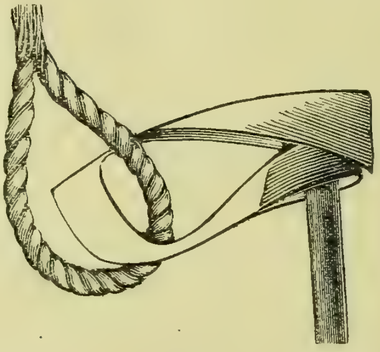
A bit of tape about four inches and a half long and three-fourths of an inch broad is taken, and the ends are stitched in halves, in opposite directions, so that the little pouches that will necessarily form will look in different directions (*i. e.*, if the one end looks upwards the other will look downwards.)



When the tape is doubled upon itself the little pouches will look in the same direction, and the corners could be made to fit each other very nicely.



To use the tape in replacing a loop of prolapsed funis one end of the tape should be passed through the loop of the cord and the upper pouch made to fit over the lower. The end of a stiff straight rod, a gum-elastic catheter with a stillette or a bamboo-stick, which, when put into the pouch, will carry the loop of the prolapsed cord, passed the presenting part into the cavity of the uterus. The presenting part is then made to fill in completely the os uteri. The introducer is taken out during a pain, leaving the bit of tape inside the uterus. The tape will come away with the placenta when the child is born.



I have to thank Dr. Joubert for allowing me to bring this simple contrivance before you. I have not seen it described in any of the English or American text-books on midwifery, with which I have come across. The method deserves to be more widely known, inasmuch as we can improvise an excellent funis repositor from a bit of tape or strong linen which can be obtained anywhere. Of course the tape should be soaked in perchloride solution (1-2000) before use.

SECTION

OF

MEDICO-LEGAL MEDICINE & INSANITY.

PRESIDENTIAL ADDRESS.

BY THE HON. W. R. KYNSEY, C.M.G., F.R.C.P.I.

GENTLEMEN OF THE SECTION OF MEDICO-LEGAL MEDICINE AND INSANITY,—My first duty is to thank the members of this Congress—which I have no doubt will mark an epoch in the medical history of the East, and confer real benefit on present and future questions—for the honour they have conferred upon me by electing me to the post I occupy to-day. I feel it, I can assure you, both an honour and a pleasure to be allowed to preside over a Section wherein the sister-sciences of Law and Medicine are united for the discussion of such subjects of interest to all classes of this great Indian Empire as those enumerated in the invitation to the Congress. My second duty is to thank the members here to-day for their presence and co-operation.

The title of the Section sufficiently indicates its scope and object, and all here will agree with me that there is no branch of our profession more neglected than Medical Jurisprudence. Its history in Europe and the East, while full of great triumphs, is also full of cases where most serious consequences resulted from inexperience and ignorance, due to the fact that few make the scientific questions involved the subject of definite and intelligent study. To no science are the remarks of Ruskin more applicable : "The greatest thing a human soul ever does in this world is to see something and tell what he saw in a plain way. Hundreds of people can talk for one that can think, but thousands can think for one who can see."

In the relations which exist between Medicine and Law, the testimony of experts is necessary for the purpose of arriving at truth, which is the ultimate object of the Medical and the Legal professions, a trial being merely a means for obtaining it. The interests of good government, the sacredness of human life, and the welfare of man, demand that no one should be accepted as a medical witness who has not made a special study of the many sciences upon which Medical Jurisprudence is founded. Medical evidence is important in all countries, but in the East it is often the only evidence at all to be relied upon, and on it alone often hangs the liberty or life of a human being.

It would be presumptuous on my part to express here opinions on many of the questions which will engage your attention. I shall, therefore, confine what I have to say to a few remarks on a couple of the subjects with which I am most familiar ; and first on—*Criminal Anthropology, Criminals, and their Treatment.*

From an early period of human history, criminalty, and the proper treatment of criminals, who are a burden in every country, has of all sociological problems been considered the most difficult to deal with effectually. Recent writers in Italy, Germany, France, America, and England have brought prominently to the notice of the medical profession, jurists, and publicists the necessity of considering, not so much our penal statutes, as the criminal himself, and the best methods to be pursued by society for his management and reformation. The writings of Lombroso, the distinguished Professor of Medico-Legal Medicine at Turin, of Ferri of Rome, Garofalo of Naples, with others of the Italian school, of Ellis in England (whose book on "The Criminal" I can strongly recommend), the work of the International Congresses of Rome, Brussels, Switzerland, and Paris have excited an enormous amount of interest throughout the scientific world. It has occurred to me that a few remarks on this subject would not be out of place here, considering its magnitude and importance in the East.

The term "Criminal Anthropology" was first given by Lombroso to that branch of morbid psychology which is concerned with the study of the physical and psychical peculiarities found in criminals, and it deals with all the problems connected with the criminal as he is in himself, and as he becomes in contact with society. He maintains that by its means it is possible to determine the probability of a prisoner's reformation, and the best methods by which this can be effected ; but it cannot of course be used to discover the author of a crime, although by means of measurements prisoners can be easily identified accurately.

Criminals have been classified by Professor Benedikt on a pathological basis into *homo criminalis* (with normal characteristics), *homo criminalis neurasthenicus* (the professional criminal), *homo criminalis degeneratus* and *homo criminalis e morbo aut intoxicatione ;* and on a clinical basis by Professor Enrico Ferri into (1) the political criminal, who may be, as Lombroso calls him, "the true precursor of the progressive movement of humanity," and may be the hero, martyr, or even saint of another land or age ; (2) the criminal by passion, usually distinguished by a previous honest life and genuine remorse, he never becomes a recidivist—hi crime is usually a solitary event in his life ; carefu examination, as a rule, fails to show any striking evidence of abnormality, degeneration, or hereditary taint in the political criminal or criminal by passion ; (3) the occasional criminal, who has an element of innate criminality which leads him to commit crime when an opportunity offers—bad heredity is common in this class ; (4) the habitual or professional criminal, who deliberately adopts a career of crime, and commits it either helplessly, the degenerate class, or with great intelligence, the aristocracy of criminality ; (5) instinctive or congenital criminals (*criminel-né* of the French, *delinquente-nato* of the Italian). Lombroso identifies the instinctive criminal with the moral insane. Criminals of this class form only a small percentage of the prison population, but they are the most serious proportion. They frequently present well-marked physical and psychical signs of abnormality, degeneration, or disease. They reveal criminality in its most pronounced shape, and they are related on one side to the occasional criminal, and on the other pass gradually into (6) the insane criminal, without any clear line of demarcation between the two.

The Italian school, and those who think with them, consider criminality from a scientific point of view, and assert that it is a neurosis originating either in an inherited or an acquired condition of the brain, which may be actual disease resulting in degeneration, or the non-development of certain faculties, the existence of which would preclude the possibility of crime. Criminality is a sign of physical degeneration of the nerve centres, crime its outward expression. Crime is not then the result of personal spontaneity, but springs from the secret forces of organization, and is a symptom of moral alienation due to inherited vice of character over which the criminal has no more control than the lunatic. They answer the question : " Why is a man a criminal ? " by replying : " For the same reason that another man is a moralist or an honest, law-abiding citizen." A criminal inherits a brain incapable of generating moral faculties, or through the influence of his environment his mind does not evolve sufficient moral strength to control his appetites and passions. It is no more difficult to believe that brain development in the evolution of mind may stop short of completely unfolding the moral faculties than it is to believe that it may, as it certainly does in many cases, stop before high intellectuality is attained. Whether a man will commit crime at all depends to a great degree on his constitutional characteristics and education, and the nature of his crime on his environment, inherited tendencies, or both. It is difficult to say how much can be attributed to heredity, how much to environment, as the fall from virtue to vice in any one is possible, but the number of healthy, carefully brought up children who adopt a career of crime is very small, and such cases are generally curable. The habitual and instinctive criminal, on the other hand, comes from a family in which inebriety, insanity, and criminality are hereditary, and whose members are surrounded by physical and social defilement. As there are anomalies, monstrosities, infirmities, and natural imperfections in the physical and intellectual world, there are the same in the moral, and the criminal differs physically, mentally, and morally from the honest member of society as much as the imbecile from genius.

Maudsley, who has written wisely and well on the subject of criminality, says : " The criminal class constitutes a degenerate or morbid variety of mankind : they are, it has been said, as distinctly marked off from the honest and well-bred operatives as black-faced sheep are from other breeds, so that an experienced detective officer or prison official could pick them out from any promiscuous assembly at church or market. They herd together in our cities in a thieves' quarter, giving themselves up to intemperance, rioting, and debauchery, without regard to marriage ties or the bars of consanguinity, and propagating a criminal population of degenerate beings." The physical and mental peculiarities of the criminal which bias his character and irresistibly impel him to crime have been carefully studied. Their heads differ little from the average. Thieves usually have small heads, and murderers large ones ; the cephalic indices are not infrequently an exaggeration of those of the race to which the criminal belongs ; abnormality or irregularity in shape is frequent ; the orbital capacity is great, frontal crest prominent, and the medium occipital fossa is often present ; signs of old meningitis, pigmentation, cysts, and degenerating capillaries are frequently observed on *post-mortem* examination. The weight of the lower jaw is considerably above the average, and the zygoma is usually prominent ; the ears are large and outstanding and often abnormal ; wrinkles are precocious and well marked ; the beard is scanty, and the hair on the head abundant. Muscular and sexual anomalies, pigeon breasts, imperfectly-developed chests, and stooping shoulders abound ; heart disease, left-handedness, absence or exaggeration of the tendon reflexes of the knee, anæsthesia, analgesia and disvulnerability, or rapid recovery from wounds, are common. The sensibility is much less than that of normal persons ; the eyesight is inferior, and hearing obtuse, with great proneness to disease of the ear ; the sense of taste is less developed than in the normal man ; sexual precocity, showing itself both in natural and unnatural forms, is excessive. Marro has found that the proportion of criminals whose parents were very young or very old at conception is decidedly greater than of ordinary persons.

Despine, in his great work, " Psychologie Naturelle," considers that the great psychical conditions for crime are moral insensibility, absence of real remorse, perversity, with imprudence, vanity, and lack of forethought. Of 400 murderers, Dr. Bruce Thompson of Perth only knew three to express remorse ; of the 4,550 prisoners who passed through Elmira, 34 per cent. showed on admission no susceptibility to moral impressions, 23 per cent. were ordinarily susceptible. Salsotto studied 130 women condemned for premeditated assassination, or complicity in such assassinations. He could only recognize genuine penitence in six. He concluded from his observations that penitence is seldom real, and that real penitence is not obtrusive.

The criminal is not necessarily diseased, but there generally exists a latent neurotic bias, if not actual neurotic disease, such as epilepsy, inebriety, or insanity ; and he is frequently scrofulous or tuberculous, all indicating nervous and bodily degeneration. Mentally he can reason about the crimes committed, but he cannot comprehend any moral wrong, and, conscious of punishment for past offences and almost certain of it for future ones, rushes wildly, heedlessly, remorselessly, into the vortex of criminality, and never pauses until the arm of the law interferes to protect society. Despine, in his exhaustive study of the criminal's mental nature, says : There must be something abnormal in the disposition of criminals when they yield with the utmost facility to desires which would excite the strongest repugnance and horror in a truly moral man. Does not this abnormal state reveal itself in the clearest manner when, contrary to what poets and moralists have represented, we see the wretch who has committed a crime exhibiting no symptoms of remorse, but rather a disposition to repeat the same criminal act ?" He drew from this the conclusion that the criminal is morally insane, usually incurable, and that he should be treated in the same way as the intellectually insane person.

The heredity of specific characters is a well established fact, and the transmission of individual form or external physical characters, and even peculiarities, is universally acknowledged. The child resembles either the father or the mother, or both, or some member of the ancestral line, in general form, features, and even in colour of hair and eyes, tint of skin, and general expression. Even deviations from the normal type are handed down through several generations, and may possibly establish new species. The functions of the organism, instincts, natural and acquired, the perceptive faculties through which impressions of the outer world reach the brain and are there converted into conscious sensations, memory, emotions, reason, will, the appetites, passions, and moral impulses, normal and abnormal, and the pathological conditions to which physical and mental life are liable, are all capable of transmission under the laws of heredity from parent to offspring. "Like begets like." The hereditary character of crime was recognized in remote antiquity. Aristotle tells the story of the man who, when his son dragged him to the door by the hair of his head, exclaimed, "Enough, my son; I did not drag my father beyond this."

Inebriety, insanity, crime are closely related: each is the result of a pathological condition of the brain, each is a stage in the progressive degeneration of a family, all are hereditary, and undergo mutual metamorphosis during the stages of transmission. Of 4,550 inmates of the Elmira Reformatory, 12·8 per cent. were of insane or epileptic heredity. Of 233 prisoners at Auburn, New York, 23 per cent. were clearly of neurotic origin. Virgilio found 195 out of 266 criminals were afflicted with hereditary diseases. Rossi found to 71 prisoners, 5 insane parents, 6 insane brothers and sisters, and 14 cases of insanity among more distant relations. Marro found the proportion of prisoners with bad heredity was 90 per cent. Penta found among the parents of 184 criminals, only 4 or 5 per cent. were quite healthy. Alcoholism in either parent is frequently associated with criminality in the child. Of the 4,450 criminals of Elmira, drunkenness clearly existed in the parents in over 38 per cent. In Rossi's 71 criminals, whose ancestry he was able to trace, in 20 the father was a drunkard and in 11 the mother.

Thirty years ago Dr. Bruce Thompson, Physician to the Prison at Perth, Scotland, proved the existence and self-perpetuation of a criminal class. He states that of 5,432 prisoners he found 673 whose mental state appeared to be unsound, though they were not, according to general opinion, proper subjects for an asylum. Out of 904 convicts, 440 were recommitted. In a house of detention 109 criminals came from 50 families, one family having furnished eight. In America the Jukes family in seven generations furnished 709 criminals.

I have endeavoured to show that many eminent writers look on crime as the result of disease of the brain, and in consequence advise the treatment instead of the punishment of this morally diseased class, and urge that the problem of prison administration is how to treat prisoners with the least burden to the community, and at the same time secure ultimately the best advantages to the criminal. "The prison is the battle-field between vice and virtue, with the advantage of position and numbers on the side of vice." The modern school on this vexed question have no faith in punishment as such, but believe in correctional treatment, their motto being that every prisoner carries with him the possibility of good citizenship. Prison treatment should be no doubt both punitive and deterrent, but should also have for its object the permanent improvement rather than the deterioration of the prisoner's character; and, unless jails are properly managed on these principles, the State practically undertakes the criminal education of the dangerous classes. Crime can never be diminished through fear of punishment; and the benefits to be derived from the conviction and imprisonment of criminals increase in proportion as penal and retributive methods give place to more enlightened reformatory methods. In America 60 to 70 per cent. of juvenile prisoners are reformed.

The causes of crime have been most carefully classified under *cosmic*, such as climate and diet; *biological*, such as personal peculiarities, anatomical, physiological, psychical; and *social*, which includes economic perturbations, alcohol, pauperism, etc.; but the chief factors have always been and ever will be heredity, a vicious life, alcohol, a woman, a knife, caste, race, and religious prejudices.

If it is admitted, as it must be I think, that every truly criminal act proceeds from a person who is temporarily or permanently diseased, the older views on punishment will have to be considerably modified. As it has hitherto been directed at the offence, and it was not considered necessary to take the offender into account at all, the result has been most unsatisfactory, as statistics on the phenomena of recidivism prove, and the main cause of recidivism is the failure of prisons to act as reformatories. Laloue, the Inspector-General of Prisons in France, says: "With our existing system twenty-four hours' imprisonment suffices under certain circumstances to ruin a man."

"As to the reformation of the criminal," remarks Dr. Paul Aubrey, "that is a myth; the prison is still the best school of crime which we possess;" and a young Italian thief said: "The houses of correction are much more houses of corruption!" In this place, for obvious reasons, I can only very briefly allude to the main proposals of prison reformers. They are:—

(1) To remove the belief that the criminal is an average human being, but to look upon him as an abnormal member of society, and to make the prison "a moral hospital" for his treatment and cure. Sir Thomas Moore long ago said that the end of punishment "is nothing else but the destruction of vices and the saving of men."

(2) To abolish the definite and pre-determined sentence, and to substitute for it an indefinite one. This removes from the judge, who must be ignorant of the nature of the individual before him, the power of definitely fixing the period of confinement in prison, and transfers it to the managers of the reformatory, who have the power, if they see fit, to let prisoners out on parôle (ticket-of-leave) at any time after a probationary period. Since the introduction of this system into the Elmira prison at New York several thousand prisoners have passed through it, and only a small percentage prove recidivists; it was first suggested by two Englishmen, the brothers Frederick and Mathew Hill, and independently by Garofalo of Naples.

(3) To improve the prison staff, under the belief that the prison warder of to-day is as well fitted for the treatment of criminality as the hospital nurse of half a century ago was fitted for the treatment of disease. No one should be appointed to the care of criminals who has not been specially trained for the purpose.

(4) To educate the criminal physically, mentally, and industrially by means of skilled teachers, so as to win him back from the anti-social to the social world, and to give him when he leaves the prison a trade or means by which he can earn an honest livelihood.

(5) To introduce a sound system for the identification and registration of criminals. The recognition of the habitual criminal is one of the most delicate and difficult functions of the police: they are blamed if they fail in identifying, and doubly blamed if they mistake an innocent person for the real offender. Both identification and registration can be accurately and unimpeachably carried out by the anthropometric system of Bertillon, which consists in the measurement of parts of body which do not alter with age, accident, thinness, or corpulence of the individual, combined with a record of marks, profile and three-fourth face photographs. The measurements are the machinery of identification; the personal marks are the proofs.

It is worthy of note that the Japanese have had for ages a system of prison treatment very similar to that which our most advanced thinkers now recommend, in which every prisoner is taught to do that at which the limit of his natural faculties is reached, and where the only method of punishment is one dark cell seldom used, and flogging is unknown.

(6) To deal with the occasional criminal by substituting "liability to punishment" for actual detention in jail.

This Section is not the one to deal with the question of prison mortality, as its consideration would involve a history of the diseases of prisoners and many other points; but as it is a subject of the deepest interest to all engaged in jail administration in the East, I may be permitted to make a few remarks. Writers at home are very fond of contrasting the death-rates of British and Indian jails, to the detriment of the latter, from want of knowledge. I am certain every one who has had the management of prisoners in the East will allow that mortality in prisons depends largely upon (1) the class of prisoner admitted, whether he is selected, the nature of his occupation in the free state, and whether he comes from a malarious or healthy district. The enormous influence of malaria in augmenting Eastern prison death-rates has not been taken sufficiently into account, and it is a curious fact that the removal of prisoners from malarious districts to healthy ones is often disastrous. (2) The discipline and nature of his labour in jail. The stricter the discipline and the more *continuously* prisoners are made to work, even irrespective of its amount, especially if never accustomed to work before or if they are employed at work to which they were previously unaccustomed, the higher the death-rate. (3) Diet, whether there is change to unaccustomed food, and whether it is too much or too little. (4) The early detection and treatment of disease. My experience is, that as well as malingering, there is a good deal of concealment of disease and actual indifference about health. If Eastern prisoners could be treated as the following extract shows they are pampered in England, I have no doubt their sick and death-rates would be as low:—

"The Commissioners of Prisons in their report for 1887-88 attribute the low rates of sickness and mortality to the improved dietary, which gave the prisoners a sufficient amount of food composed of proper ingredients, and they claim for it the great merit of simplicity and economy. The yearly average death-rate for the $16\frac{1}{2}$ years ending March 1878 was 11·6 per mille, while for the ten years ending March 1888 it was 8·1. The Commissioners state that imprisonment as now generally conducted in England is a condition more or less akin to physiological rest. The struggle for survival is suspended, and the prisoner appears to feel that the prayer for daily bread is rendered unnecessary by the solicitude of his custodians. Tranquillity of mind and freedom from anxiety are leading characteristics of his life. From the moment the prison gates close behind him the tendency in most cases is to lessened waste of tissue: he lives in fact less rapidly than before.

"He is insensibly subdued to settled quiet," and finds in many instances a peace and repose to which, as a law-abiding citizen, he was perchance a stranger. The work exacted of him is never excessive; that, as a rule, he is free from worry; that he is well clothed and housed and surrounded even in the depths of winter by a warm atmosphere; that he spends nine hours out of every twenty-four in bed, does nothing on Sunday, and is exempt from distracting emotions and desires. Finally, he is scrupulously protected from all preventible bodily suffering, and may be said to be an inmate of a hygienic hospital for the promotion of the physical and mental health.

The second subject I wish to say a few words about is—

Insanity.—There never was a period of human history when insanity did not exist, and it would be strange if this were not so, with the brain, the organ of mind, liable to have its development arrested, its functions disordered, or its action suspended, and the type of mental and nervous disease which exists in different races and ages is exactly that form which is in in accord with their respective mental development—the most common in the savage is imbecility, in children idiocy. There can be no moral insanity where there is no moral sense, and no ideational in infants because they have no ideas. The period of the world in which we live is characterized by an enormous increase in frequency of neurotic affections, due to the unparalleled activity and progress, rush and worry of modern life, a life of anxiety and high tension. The rapid cultural development of our time, gratification of ambition, change in the whole style of existence, strife of competition, and the desire to grow rapidly rich, have made nations and individuals discontented. As Horace said two thousand years age —

> Qui fit, Mæcenas, ut nemo, quam sibi sortem
> Seu ratio dederit, seu fors objecerit, illa
> Contentus vivate ; laudet diversa sequentes."

In other words, the rapid advancement of our civilization, with the conditions of the new age, and the problems which it raises in intellectual, political, and social existence, has not been effected without mental strain and large expenditure of nerve force, because the change has unfortunately brought with it bad habits not known before, and displaced many old restraining influences which it would have been wise to preserve until something better in their place had been established. Insanity, like criminality, waits on civilization, which Carlyle says " is merely a covering underneath which the savage nature of man burns with an infernal fire," and the reason for this is not difficult to explain, as there can be no doubt that there is an increasing complexity of the brain, the result of this higher civilization, march of education, and struggle for existence, and, like all machinery, the more delicate its mechanism becomes the more liable it is to get out of order, and the more difficult it is to re-adjust it again. One melancholy evidence of the increase of insanity is the increase in number and size of the asylums which Christian benevolence and statesmanship have established for the custody and treatment of persons mentally afflicted.

In Ceylon the admission rate continues to increase, the percentage of recoveries on this rate being about 52 per cent., and the cases are of the usual mental types. The uneducated brain of the native is not usually roused to excessive fabrication of ideas even by insanity, his mental symptoms being more a monotony of noise, bad language, and filthy conduct. In all delusional cases, the patients are persons of education—an example of its effect in enlarging the capacity of mankind for misery. The causes are even more difficult to ascertain than in Western countries, but all experience is against the influence of opium as an important factor in its causation ; but there is no doubt about *bhang* being morally and mentally injurious.

In an inquiry which I made some months ago into the opium and *bhang* question with the Inspector-General of Prisons, we found that the average importation of opium for each year of the decade, 1871—80, amounted to 9,622lbs., while for each year of the decade, 1881—90, it amounted to 9,957lbs., an increase of 385lbs., or 3·5 per cent. on the annual importation ; but taking into account the increase of population, there was an actual decrease per head. In the first period one pound of opium was consumed by, or at least imported for, every 208 persons ; in the second period one pound was consumed by, or at least imported for, 302 persons : in other words, it now takes 302 persons to consume what was formerly used by 208.

As regards race, Malays are most addicted to this drug, Moors probably come next, the Sinhalese next, then the Tamils, and lastly Benghers and Europeans.

We found no satisfactory evidence that the abuse of opium as distinguished from its use was on the increase, nor was there any evidence to show that the abuse of the drug has extended beyond a very small section of the community, and the admission to hospitals and asylums has not been influenced to any appreciable extent thereby. We were convinced of the enormous benefits which resulted from its judicious use, and we had reason to believe that a not inconsiderable portion of the drug imported was used in the treatment of animals ; further that any considerable diminution in its importation would involve a considerable increase in human and animal suffering.

We were strongly of opinion that the use, even the abuse, of opium had not tended in any way to increase crime or insanity, though in certain cases it may have exercised an enfeebling influence over mind and body.

As regards *bhang*, we found many cases on record in which it had been the immediate cause of crimes of violence, and we advised that its use should be restricted as far as possible by means of a heavy import duty and the prevention of its cultivation in the island.

My belief is that natives who use opium have selected the least harmful form of stimulant, one which rarely acts as a cause of crime, insanity, or disease, and that any unwise interference will practically substitute alcohol, with all its dreadful immediate and remote effects, for opium. The agitation against it seems to be the result of ignorance.

I have seen a few cases of that curious and dangerous condition known as running amuck, or amok, among Malays, due to *bhang* and perhaps to opium. It is no doubt a transitory form of madness closely related to *epilepsia cursiva* of Bootius, in which the person commences running and then falls down in a fit. Wallace suggests " that it is a resort to what appears to a savage to be a kind of honourable suicide on the part of a man who for some reason is plunged in sorrow and dejection, thinks himself wronged by society, or to whom on account of misfortune life has become a burden."

Trusting that my remarks have not been too long, and thanking you for your attention, I now give place to those who have prepared papers which we have all come here to hear read.

ON SOME POINTS IN CASES OF ARSENICAL POISONING.

BY R. HARVEY, M.D., F.R.C.P.,
Surgeon-Colonel, I. M. S.

GENTLEMEN,— In my report on the Medico-legal returns of the Bengal Presidency written in 1873 (p. 252), I wrote:—

> "It must be remembered, however, that there is a class of cases, rare indeed, yet sufficiently attested, where the arsenic exercises its powers primarily and exclusively on the nervous system, the patient dying, often rapidly, in a state of profound collapse or coma, and no local lesions whatever being found in the stomach or bowels. This point is one of great importance, and should never be lost sight of. In at least four instances in the present returns the absence of congestion in the stomach was held to contra-indicate arsenical poisoning, and no analysis appears to have been made. The substance of one will suffice. A gambler and *ganja*-smoker, who had left home, taking some ornaments with him, was found cold, insensible, and insufficiently clad. He revived a little in the sun, but soon after died. The report of the native doctor, who saw him alive, is not given. On dissection the pupils were found dilated, and the brain and its sulci congested, appearances compatible with poisoning by *bhang* or *datura.* The lungs were frothy and œdematous; all the other organs healthy. The parts of the case, bearing upon the question at issue, are as follows:—
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> "Stomach was much distended with a yellow, watery fluid, with a few split vetches in it; no characteristic smell. Mucous membrane covered with a viscid, yellow-coloured mucus, no irritation marks. . . . . Both sides of heart contained greenish, straw-coloured jelly consistence material, also dark clots and fluid black blood. . . . . The absence of stomach irritation marks, its being full, and the intestines containing fæces, altogether militate against poisoning by a mineral.
>
> "This case and the others like it may not have been examples of arsenical poisoning, but the cause of death was not ascertained, and viscid yellow-mucus in the stomach and greenish yellow deposit in the heart are suggestive." *Vide* pages 255-56 below:—
>
> "That a non-congested stomach contra-indicates arsenical poisoning is disproved by several cases. One from Amritsar, where slight congestion at the brain and lungs was the only abnormal appearance, has been noticed above. In another, reported in the Bijnor return for October 1870, the body was so decayed that no accurate opinion could be formed as to the cause of death. The stomach contained about two ounces of greenish fluid, with green particles floating in it, but *its mucous coat exhibited no trace of inflammation*—a point which Dr. Hilson remarks on as noteworthy. Arsenic was found in it by the Chemical Examiner. In another, reported by Dr. Quinnell from Jhung (Lahore circle), in November 1870, the symptoms preceding death were vomiting, purging, dryness of the mouth, thirst, anxiety, vertigo, and prostration, and death occurred in nine hours. On *post-mortem* examination, the brain was found congested, with slight extravasation of blood at its base; but *the whole of the intestinal tract*, the lungs, heart, liver, spleen, kidneys and bladder were found healthy. A second woman, who recovered, had well-marked primary symptoms of arsenical poisoning, with swelling of the eyelids, itching of the surface of the body, and partial paralysis of the extremities as secondary effects. There was no epigastric tenderness or pain, possibly because the poison was taken in food, and for the most part rejected by vomiting; arsenic was detected by the Chemical Examiner. In another case, in the Hosangabad return for September 1872, a hospital assistant found '*nothing suspicious*' in a body said to have been poisoned by arsenic. The Chemical Examiner found arsenic in the stomach of the deceased, and in the remains of the bread which he had eaten." Another example is given at page 258: "In several cases, where arsenic was found in the stomach, only a slight degree of congestion existed, and the cases above given suffice to show that *in cases of suspected poisoning by arsenic chemical analysis should always be resorted to even when no local lesions are apparent,* unless, indeed, some other cause of death is plainly made out."

I bring this long quotation before you, because in spite of the fact that the occasional occurrence of such cases as those quoted is recognized in most text-books, no stress is laid on them; and it is still not uncommon to find in cases of suspected poisoning by arsenic the absence of symptoms of gastro-intestinal irritation held by some medical men to be evidence that death could not have been caused by arsenic. Similarly, the absence of pain, of vomiting, of persistent thirst, of purging, are supposed to contra-indicate the suspicion of arsenical poisoning, and there is reason to suppose that this comparative ignorance of these exceptional cases may and does now and then lead to the escape of a guilty person.

There can be no doubt that in the immense majority of cases the symptoms and *post-mortem* appearances are those of intense irritation, and this is dwelt on so much that it takes a fixed hold on the mind, while the exceptional cases, though mentioned, are forgotten. It thus happens that when a case does occur it is apt to be overlooked, even by men of considerable medico-legal experience. In a celebrated English case, it was maintained for the defence that death could not have been due to arsenic, because of the very slight degree in which symptoms of irritation were present before death, although arsenic was found in the body, in the medicines and in the beef-juice; and I have noticed numerous cases in this country where opinions were given that death was not due to arsenic, owing to the absence of the usual *post-mortem* appearances, and where the viscera do not appear to have been subjected to analysis.

In the case of recorded cases such mistakes are not creditable to those who make them, though there is this excuse for them that, though mentioned, they are not insisted on in the books. Thus Woodman and Tidy ("Forensic Medicine and Toxicology," 1877) say: "We invariably find violent vomiting" (p. 134), a statement which goes far to undo the effect or the mind of the student of the remarks on the next page that in some cases we have "collapse, with or without (as happens in some very exceptional cases) pain, vomiting, and diarrhœa." Again, "sometimes the patient dies without literally any bad or severe symptoms at all" (p. 135). Yet, again, "we may remark first that several cases are recorded when no special after-death appearances were discovered. . . The *post-mortem* appearances usually discovered are those common to the action of irritant poisons" (p. 137). No special attention is called to the necessity of analysis in all cases where the administration of arsenic is suspected.

Messrs. Taylor and Stevenson ("Principles and Practice of Medical Jurisprudence," 3rd Edition, 1882) insist very strongly on the inflammatory symptoms and appearances, and only mention the exceptional cases in the most casual and incidental way. Thus they say: "Although pain is in general among the early and well-marked symptoms, arsenic appears in some cases to destroy sensibility" (p. 257). "There are many anomalous cases on record (they are speaking of chronic poisoning) in which the symptoms have diverged so much from the ordinary course as to embarrass medical practitioners" (p. 258), and they note the absence of vomiting and purging in one case. If medical practitioners would remember these anomalous cases and send the viscera for analysis in all cases of supposed arsenical poisoning, some at least of this embarrassment would be avoided.

Messrs. Guy and Ferrier ("Forensic Medicine," 6th Edition, 1888), after describing the usual symptoms and appearances, say: "But the most remarkable *post-mortem* appearance is the absence from the living membrane of the stomach of all trace of inflammation and of every other characteristic change" (p. 409). Yet no stress is laid on this, and the need of analysis in all cases is not mentioned.

Lyon ("Medical Jurisprudence for India," 1890) also fails to point out the necessity of analysis in all cases, though he fully recognizes the occasional absence of the usual symptoms and *post-mortem* appearances. "In a few acute cases," he says, "irritant symptoms are absent or slight, and the nervous symptoms well-marked. Such cases usually prove rapidly fatal either by collapse or coma" (p. 144). He gives a series of illustrative cases and recalls attention to Christison's fourteen cases, in which only slight irritant symptoms were present, while in five of the fourteen *post-mortem* appearances of irritation were either altogether absent or trifling only (p. 443.)

Messrs. Gribble and Hehir ("Outlines of Medical Jurisprudence for India," 1892) clearly describe the exceptional cases: "The pain may be absent or but slight. Vomiting and purging do not occur in all cases, nor is thirst—a most persistent symptom—always foreseen" (p. 412). Yet they also fail to insist on the necessity of analysis.

Mann of Manchester ("Forensic Medicine and Toxicology," 1893), whose book, besides being the latest, is one of the fullest and best that I know, is perfectly clear as to the occasional occurrence of "exceptional cases (in which) poison seems to spend its force on the *nerve centres*, the gastro-enteric symptoms being less pronounced, or they may be entirely absent. In such cases from the very first extreme collapse occurs, with superficial and deep anæsthesia of the limbs, faintness, extremely small feeble pulse, and coma" (p. 430). "In those exceptional cases in which paralysis of the nerve centres is substituted for the usual gastro-enterites, the appearances presented by the stomach may be comparatively trifling." No description could be better, yet here again we have no stress laid on the necessity of analysis.

It may doubtless be said that in all cases of suspected poisoning, analysis is had recourse to as a matter of routine, and in England this is, no doubt, true to a great extent, although we find in the records pigment cases, in which it was not done even when inflammatory appearances were present. In India, however, there is considerable reason to think that the absence of the usual symptoms of irritant poisoning during life and of gastro-enteric inflammation after death would by many be taken to contra-indicate any supposition of arsenical poisoning, and thus render analysis unnecessary. In England also, I believe, that unless something had occurred to assure suspicion, these anomalous cases would most frequently be mistaken for something else, and would very naturally be embarrassing to medical practitioners strongly imbued with the general idea that arsenic always causes marked gastro-enteric symptoms. The mistake would be a natural one, and my object in bringing the subject to your notice is to recall attention to the subject, and to again insist, as I did 22 years ago, that "*in cases of suspected poisoning by arsenic, chemical analysis should always be resorted to, even when no local reasons are apparent*, unless, indeed, some other cause of death is plainly made out." I might even go farther and say that in all cases of sudden death from collapse or coma, analysis should be made, even when there is nothing to indicate arsenical poison, unless cause of death is clear. Arsenic is so common a poison in India that the number of anomalous cases is probably large. A considerable number are on record, and it behoves us to do our best to detect them. If the above rules are kept in mind they will be less likely to escape notice.

One other point deserves more attention than it receives from English writers—I mean the occurrence of sub-endocardial ecchymosis. It was present in 23 out of 33 instances, in which the condition of the endocardium is mentioned in the arsenical cases in my report, and in only three other instances (all of them cases of strangulation) out of the whole series. Briand and Chaudé describe it as very frequent, and Tardieu says it occurs "*à peu pres constamment.*" It has always been present in the cases of arsenical poisoning examined by me, probably a dozen at least. Whether it occurs in the anomalous cases where the gastro-intestinal tract escapes, I do not know; for in none of those I have quoted is the condition of the endocardium mentioned. Very probably it does not, but if it does, it would be a very valuable indication. I should always myself suspect that I had to do with a case of poisoning by arsenic if I found the ecchymosis. They are most characteristic and cannot fail to be recognized if looked for. I have seen them nearly quarter of an inch in depth in the ventricular wall. When on the valves or fleshy columns they are even more conspicuous.

THE NECESSITY FOR AN ACT RESTRICTING THE FREE SALE OF POISONS IN BENGAL.

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A VERY large number of cases of poisoning occur annually in Bengal, and as none of the safeguards against their occurrence in vogue in England and other European countries exist in Bengal, it naturally suggests itself whether, considering the difference of population, the number of cases of poisoning is excessive; and, secondly, whether the number of cases of poisoning is capable of reduction. Throughout the length and breadth of India, except in Bombay, the sale of poisons is absolutely free and unrestricted. Arsenic, aconite root, nux vomica seeds, and other deadly poisons may be bought by man or woman in almost any quantity and without question. Many potent poisons, such as datura, oleander, grow wild or almost so in many parts of India, so that any measure prohibiting the possession of such poisons would be very difficult to enforce. The drugs, however, most frequently used as poisons do not grow wild, but can be easily purchased in any bazar in India.

In the population of every country, there are some with criminal instincts ready to turn to account any opportunity that exists for the committal of crime. It is individuals of this class, who, by association and habit of life, would come to learn the nature and appreciate the use of a poison. So long then as criminals exist, the free traffic in poisonous drugs is attended with very considerable danger to the population in general. This being so, the necessity of placing the sale of poisons under legal restrictions has often been represented to Government by those well qualified to speak with authority on the subject. Government has, however, hitherto declined to take action in the matter, and on several occasions has assigned definite reasons for declining to take action. Admittedly, on all hands, the restriction of the sale of poisons in India is by no means so simple and easy as in England. Certain difficulties are self-evident, and these have apparently strongly influenced Government in its decision. Our object in bringing the matter before the Medical Congress is to invite discussion in the hope that some feasible plan of dealing with an admitted evil may be evolved. The reason for particularising Bengal as the subject of our paper is, *firstly*, that there is already in existence a Poison Act in Bombay; and, *secondly*, that complete statistics with regard to other provinces are not available. However the few statistics that we have been able to collect with regard to the prevalence of the crime of poisoning in other provinces unmistakeably show that what is true for Bengal is also true for her sister presidencies. In our opinion, it is not only possible to restrict the free sale of poisons, but we believe, also, that such restrictions will be followed by a permanent diminution of crime. We are supported in this belief by the opinions of many persons who have devoted considerable attention to the matter.

From natural and other causes peculiar to India, the subject has many bearings. These can best be considered under the different sections into which our paper is divided. We have arranged the matter treated in our paper under the following heads:—

A.—Prevalence of poisoning in Bengal as compared with England and the necessity for accurate statistics regarding cases of poisoning in Bengal;
B.—Nature of the poisoning which occurs in the province of Bengal;
C.—Measures proposed with the object of restricting the free sale of poisons.

A.—The prevalence of poisoning can only be judged from the number of cases of fatal and non-fatal poisoning annually reported. At the present time in the province of Bengal, no report is available regarding the total annual number either of fatal or non-fatal cases of poisoning. The Police Administration Reports deal naturally with criminal poisoning only, and contain no reference to instances of accidental poisoning. The Chemical Examiner's Report is simply the record of the results of the chemical examination of viscera, vomited matters, and other articles that may be referred for examination. It does not profess to be a return even of total suspected cases of poisoning, and affords no information as to the nature of the cases whether fatal or non-fatal, and, if fatal, whether suicidal, accidental, or homicidal. The Report of the Health Officer of Calcutta and the Calcutta Police Administration Return deal with fatal cases of poisoning more in detail, but have reference only to Calcutta and its suburbs.

English statistics divide fatal cases of poisoning into *murder by poison*, *suicide*, and *accidental death from poison*. The latest English statistics which we have been able to obtain refer to the five years, 1876 to 1880. During this period there occurred 12 cases of murder by poison, 642 cases of suicide by poison, and 927 cases of death from accidental poisoning. Let us first deal with the crime of murder by poison. As just stated, 12 cases occurred in England during the five years, 1876 to 1880, or an average of ·07 per million of the population in each year. During the same period of time in Bengal, the Police Administration Report shews that 94 cases of murder by poison occurred, or an average of ·31 per million in each year. Accordingly, for the period under reference, the crime of murder by poison was rather more than four times more prevalent in Bengal than in England. The Police Administration Reports for the last five years, *viz.*, 1889 to 1893, shew a slight reduction in the number of cases of murder by poison, 81 cases having occurred, or an average of ·23 per million of the population. The crime is, therefore, still three times more prevalent in Bengal than in England.

It is admissible, we think, to refer here to the nature of the scientific evidence on which the charge of poisoning rests. First in importance is the evidence of the doctor who has treated the sick man, and that of the medical man who has made the *post-mortem* examination. Next comes the result of the chemical examination of viscera, vomited matters, stomach washings, etc. Chemical examination is often negative for many reasons: the poison may have been absorbed and destroyed in the organs of the body; it may have been voided by vomiting and the vomited matters lost; or it may have been removed by prompt remedial measures. It is partly on this account that in an enquiry as to the prevalence of poisoning that the Chemical Examiner's reports afford so little assistance. There is also another reason why the Chemical Examiner's reports are incomplete. In many instances, where the medical officer holding the *post-mortem* examination finds a sufficient quantity of recognizable poison in the stomach to enable him to give a positive opinion as to the cause of death, the cases are never referred to the Chemical Examiner at all. We do not suppose this is ever done in cases of suspected murder by poison, at least it ought not to be; but it does take place in cases of suicide, the prevalence of which class of poisoning we now pass to consider.

As already stated, the English statistics for the five years, 1876 to 1880, shew that 642 cases of suicide by poisoning occurred or 3·55 per million of the population in each year. In Bengal, the report of the Sanitary Commissioner shews that the total number of suicides from all causes occurring in the province during this period was 11,662 or 38·8 per million of population per annum. For the last five years the numbers are 15,743, or 45·8 per million per annum. The number of suicides from all causes occurring in England and Wales in the year 1875 gives an average of 65·2 per million of the population. So far then as can be ascertained, suicide is less frequent in India than in England. We are however more concerned with the methods of suicide as practised in the two countries. In England, suicide by poison constitutes about 12·25 per cent. of the total cases of suicide, giving as stated above an incidence of suicide by poisoning equivalent to 3·55 per million of the population per annum. We regret to say that no returns are available for the whole province of Bengal to shew what proportion of the suicides is due to violence and what to poison; nor are all the cases of suspected suicide by poisoning that occur referred to the Chemical Examiner. Thus Surgeon-Major J. B. Gibbons, Police Surgeon of Calcutta, informs us that out of 44 cases of suicide by opium examined by him in the year, 1st June 1893 to 1st June 1894, he sent only 18 cases to the Chemical Examiner. In the remaining 26 cases, there was a sufficient quantity of opium in the stomach to enable him to ascribe the deaths to the action of the poison without the help of chemical analysis.

We are not, however, without some data as to the incidence of suicide by poisoning in Bengal. For the reports of the Commissioner of Police of Calcutta afford much more accurate information regarding the occurrence of suicide by poison in the town and suburbs of Calcutta than is available for the rest of the province. Thus, during the five years, 1876 to 1880, 126 cases occurred, or an average of 36·42 per million per annum. For the five years, 1889 to 1893, 236 cases occurred or an annual average of 68·84 per million. Of these cases, 23 were due to arsenic, 167 to opium, and 46 to other poisons. Of the total cases of suicide in the town and suburbs of Calcutta, 55·8 per cent. were due to poison as against 12·25 per cent. in England. These figures also shew that suicide by means of poison is about nineteen times more prevalent among the population of the town of Calcutta than it is generally among the population of England.

Is there any reason to suppose that suicide by poison is more prevalent in the large towns of Bengal, like Calcutta, than in rural districts, or may the state of affairs in Calcutta be taken as representing the conditions existing generally throughout the province? There is nothing in the available statistics to warrant the latter conclusion, and there is, on the other hand, the well-recognized fact that the conditions of life in large and wealthy cities are prone to develop those mental, social, and physical states which frequently prompt self-destruction. Painless methods of self-destruction are preferable to painful methods, and it is in large towns that a knowledge of the painless methods of ending life would most easily be acquired, and the drugs selected for the purpose be most easily procured. It is possible, however, that a considerable number of cases of suicide by poison occur in rural districts that are never reported to the police, or brought to light in any way. Instances of suicide also occurring in the families of respectable and influential individuals are, no doubt, often secretly disposed of to avoid scandal. At the present time then the available statistics afford no information as to what proportion of the total suicides occurring in the province are due to violent methods and what proportion to the use of poison. Some facts are, however, available, which go to show that, not only has suicide increased to an alarming extent in the large towns, but that the use of poison has a great deal to do with the increase that has taken place. Hanging and drowning were the methods of self-destruction chiefly selected a quarter of a century ago. To-day in the town of Calcutta more than half the cases of suicide are due to poison—a great contrast to the conditions existing half a century ago. For in the year 1850, of 21 cases of suicide occurring in Calcutta, 4, or about 20 per cent., were caused by poison, the remainder by hanging and drowning. During the year 1856, according to Dr. Woodford, then Police Surgeon of Calcutta, the proportion of suicide was 1 to 2,000 of the population of the town. The proportion of suicides to the population in the town of Calcutta, exclusive of suburbs, is now 1 to 1,300, this being the average annual incidence during the last six years. These figures show a truly alarming increase in the crime of self-destruction in the municipal area of Calcutta, and become even more significant from the fact that poison now accounts for 70 per cent. of the suicides as against 20 per cent. in 1850. In 1865, Dr. Beatson reported the occurrence of 41 cases of suicide at Dacca. Of these, one only was due to poison, 38 to hanging, and the remainder to drowning. It will be noted that the statistics, which we are able to quote, refer to only one large town in the province. Further, that these statistics are advanced as evidence of the necessity for new legislative measures. It may legitimately be pointed out that legislation, the necessity for which is based on the condition in one large town of a province with a population of 70,000,000, may not be required in the rest of the province. To this we would reply that the existing conditions regarding the sale of poisons, although possibly not productive of a large crop of suicides by poison in the rural districts, undoubtedly produce in the rural districts a great deal of other crime to which we shall subsequently refer. Further, it will be seen that the measures proposed chiefly affect the large towns.

The conditions of life in all the large towns of the province, if not exactly similar, at any rate approximate to those attending life in Calcutta. At the present time outside Calcutta but little is accurately known about the conditions existing in the rest of the province as regards the crime of self-destruction, nor is it probable that reliable information will be forthcoming, so long as the dead may be disposed of by cremation or burial without a medical certificate as to the cause of death. Naturally, it would be preposterous in rural districts to require a medical certificate as to the cause of death before a dead body could be disposed of. It is far otherwise, however, in large towns, where medical advice is plentiful, and the dead are disposed of in regular authorized places under police control. The enactment of such a measure should form the initial step. Its operation in large towns would be distinctly beneficial, enabling the authorities to estimate the amount of crime and guage the benefits or otherwise derived from legislative measures for its repression. The value and accuracy of returns relating to the prevalence and fatal nature of disease would also be largely enhanced by such a measure. It is in large towns also that deaths by poisoning of a non-criminal nature chiefly occur. For the welfare of the community, it is highly important that Government should be able to ascertain the number of such deaths. But so long as the dead can be disposed of without medical certificates, the accurate registration of the cause of death is quite impossible.

Death by poisoning of a non-criminal kind is usually described as death from accidental poisoning. Of such deaths, 927, or 5·15 per million per annum, occurred in England during the five years, 1876 to 1880. It is highly improbable that anything like this number occurs annually in Bengal. The population is for the most part agricultural, and unlikely to handle poisons with the appearance of which they are unacquainted. In the large towns, however, notably in Calcutta, a certain number of deaths from accidental poisoning occur annually. Thus in the municipal area of Calcutta during the five years, 1876 to 1880, 14 deaths from accidental poisoning occurred, or an average of 6·5 per million of the population per annum ; and during the five years, 1889 to 1893, 11 accidental deaths from poisoning are recorded in the same area, or 3·6 per million per annum. Certain types of cases of accidental poisoning are apparently almost unavoidable. Those cases, however, which arise from careless dispensing, or from the vending of drugs by ignorant, irresponsible persons, cannot be too strongly condemned. The Bengal Municipal Act, Section 252, and the Calcutta Municipal Consolidation Act, Section 368, were framed with a view to prevent such accidents. They enact that the drugs contained in the British Pharmacopœia, if dispensed on prescription, or when used by any other than a practitioner of indigenous medicine, must be prepared by a properly-qualified compounder, and sold only in registered shops. That a considerable number of these same drugs, when used by a practitioner of indigenous medicine, if not dispensed on prescription, need not be prepared by a properly-qualified compounder, and may be sold in a non-registered shop, and further that no restriction or safeguard of any kind shall be placed on the sale of indigenous remedies whether contained in the British Pharmacopœia or not, provided they are not sold in a shop where British Pharmacopœia drugs are dispensed. This matter will be referred to again when dealing with the proposed restrictive measures.

The difficulty of obtaining any adequate conception of the prevalence of fatal poisoning in the province of Bengal has, no doubt, been already realized. It is in fact only possible to speak with a certain show of authority regarding one town in the whole province, except as regards *murder by poison*.

Of the non-fatal cases of human poisoning, it is only the criminal cases that are recorded. These, for the most part, consist in the administration of stupefying drugs, generally datura, for purposes of theft. It is a class of crime fortunately very rare in European countries. The Bengal Police Returns record 161 such cases during the five years, 1889 to 1893, or an average of ·46 per million of the population. As regards other cases of non-fatal poisoning, whether suicidal or accidental, absolutely no general information whatever is to be obtained. It is possible and even probable that their number is very considerable. Thus, at the Medical College Hospital, 103 non-fatal cases of poisoning were treated during the year 1893, but in six only of these cases were the vomited matters or substances suspected to be, or to contain poison sent to the Chemical Examiner for analysis. At the Mayo Hospital, 24 non-fatal cases of poisoning were treated during the year 1893, but in no instance was the matter referred to the Chemical Examiner by the police.* The Bengal Administration Report shews that at the hospitals throughout the province, about 395 cases of poisoning are treated annually, of which 345 recover, taking the average of the four years, 1889 to 1892. The hospital records thus show a yearly average of 345 cases of non-fatal poisoning.

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* We are indebted to Dr. Kedarnath Das, Registrar, Medical College Hospital, and to Dr. Manmathanath Chatterjee, Resident Physician, Mayo Native Hospital, for the following two tables upon which the above statement regarding the non-fatal cases of poisoning has been based :—

TABLE I.

Number of poisoning cases treated in the Medical College Hospital during 1893.

Poisons.	Total admission.	Male.	Female.	Child.	Recovery.
Opium ..	66	45	18	3	45
Morphia ...	3	1	1	1	3
Arsenic ..	17	8	3	6	15
Belladonna ...	5	3	2	...	5
Atropia ...	2	1	.	1	2
Datura ..	6	4	2		6
Cannabis Indica	3	3	..	.	3
Bhang ..	1	1	...	..	1
Carbolic acid ..	2	2	.	.	2
Turpentine ..	1	...	...	1	1
Kerosine-oil ..	7	...	..	7	7
Strychnine ..	1	1	..	..	1
Castor oil seed ..	1	.	..	1	1
Camphor .	1	...	1	...	1
Aconite ..	1	...	1	...	1
Unclassified ..	9	...	..	..	9
Total ..	126	69	28	20	103

TABLE II.

Number of poisoning cases treated in the Mayo Hospital during 1893

Poisons.	Total admission.	Recovery.
Opium	28	15
Kerosine oil	3	3
Sulphuric acid ..	1	..
Carbolic acid	1	1
Camphor	1	1
Bhang	2	2
Turpentine	1	1
Aconite	1	1
Carbonic oxide gas ..	1	1
Total ..	39	25

Such is then the account that we are able to supply of the prevalence of human poisoning in Bengal, both fatal and non-fatal. It is manifest that the statistics are lamentably incomplete. More accurate returns are essential. It is hardly possible to suppose that legislation dealing with the free sale of some of the poisons at present in use can much longer be postponed. The measure of the usefulness of such legislation can only be guaged by reference to the statistics of poisoning, both before its introduction and after. It would be opportune, therefore, to now prepare the ground for the introduction of such a measure, by establishing some more accurate system for the record of cases of poisoning.

We would recommend that every case of poisoning, whether fatal or non-fatal, should be reported to the police, and further that in every case such articles bearing on the case, as may be available for examination, be referred to the Chemical Examiner for analysis. This is of course done to a limited extent in Calcutta, but it is questionable, we think, whether, in other large towns of the province, the proposed measures are adequately carried out. At least there are no records to shew the results of the action taken.

The annual reports of the Commissioner of Police, Calcutta, and Health Officer, Calcutta, already supply more information regarding the nature and frequency of poisoning for the area dealt with by them than any other similar return. We would suggest, however, that their usefulness would still further be increased by a slight addition to the tabular statements which include cases of poisoning. An extra column might be added to the tabular statement to convey information as to the evidence upon which the deaths were returned as due to poisoning, whether upon medical evidence only, chemical analysis only, or both. Such information is no doubt already available, and would certainly increase the value of these tabular statements. The record of accidental deaths in the police returns, both for Calcutta and the province, contains no return of the number due to poisoning. At present non-fatal cases of poisoning are not dealt with in either of the two reports, but were these cases all reported both to the police and the Chemical Examiner, the results of investigation could be embodied in an additional table. We are well aware that the information contained in a small tabular statement comprising a few lines often requires a considerable quantity of machinery for its accurate collection. That the larger towns in Bengal should make returns of poisoning cases among their population similar to those furnished by Calcutta, does not seem, however, to be an excessive demand. They probably are supplied with some of the requisite machinery already. The Sanitary Commissioner's report for the province records the total suicides for the year, but the number due to poison is not separately furnished. It would be a great advantage if the numbers due to violence and due to poisons could be given separately, and if the nature of the evidence upon which a suicide is declared due to poison could also be added in an abbreviated form suitable for insertion in a tabular statement. A similar remark applies to the Police Administration Report. No information is contained as to the evidence upon which cases are declared to be *murder by poison*, *drugging*, *etc.* If this could be added in a form not too bulky for insertion in Statement A, Part I, the analysis of cases of poisoning would be greatly assisted. In the same report a number of cases are returned as attempts at and abetment of suicide, but whether the attempts were made by means of violence or poison is not shewn. Hitherto we have dealt with the prevalence of human poisoning, but we referred to the fact that the free access of poison produced a class of crime almost special to the rural districts. The crime is the poisoning of animals. It is rare in Europe, but very prevalent in India. For the most part the animals are cattle, and no record of the prevalence of poisoning in Bengal under the conditions now existing would be complete, which neglected this class of crime. During the ten years ending in 1893, 1,413 head of cattle were suspected to have died from poisoning in Bengal alone. Poison was detected in 75 per cent. of the cases. Cattle poisoning is specially to be deprecated as the cattle form in many instances the sole wealth of their owners. It is hoped that the introduction of legislative measures will result eventually in the abolition of this crime. This then concludes such information as we are able to submit regarding the prevalence of all kinds of poisoning at the present time. The way has been thus prepared for the consideration of the nature of the poisoning cases which occur. Before, however, passing to this part of the subject, it will not be out of place to give a brief summary of the history of poisoning in India.

The *Skastras* here and there record cases of poisoning of kings by their nearest of kin in order to obtain possession of the throne and of husbands by their wives for reasons not very apparent. The Mahavarata records the case of Bhim Sen, the second of the Pandavas, who was poisoned by his jealous cousin and rival Durjodhan. Although one cannot vouch for the authenticity of such cases, still they tend to show that poisoning was practised by even the bold Aryan settlers of Northern India.

Sushruta, one of the oldest authorities on Hindu medicine, mentions the practice of poisoning the water sources of an invaded country with a view to destroy the unsuspecting invaders who might use the poisoned water. This practice is still extant; we hear of the poisoning of the water sources by *aconite* in Burma and Nepal at the time of the invasion of those countries by the British Army. The poisoning of water is also resorted to for the purpose of destroying fish, and thereby inflicting loss on the owner. Dr. Watt mentions the use of the following plants for the purpose: (1) Strychnos Nux Vomica, (2) Lasiosiphon Speciosus; (3) Balanites Roxburghii, (4) Tephrosia Suberosa; (5) Euphorbia Tirucalli, (6) Hydrocarpus Wrightiana; (7) Hydrocarpus Venenata. Besides these, Cocculus Indicus is also largely used for this purpose.

Sushruta also mentions the use of poisons together with harmless substances as charms and love potions.

He describes the various modes of administration of poison prevailing at the time, and although the practicability of some of these is questionable, it will not be uninteresting to enumerate them here. Thus poisons were mixed with food, drinks, tooth powder, anointing oils, honey, fragrant substances used for cleansing the body, medicine, bathing water, essences, snuff, articles used for smoking, such as tobacco, black paint, and other eye salves. It is related also that poisonous substances were sometimes sprinkled over garlands, clothes, beds, armour, ornaments, shoes, foot-stools and seats on horses and elephants.

About two centuries before the Christian era, the whole dynasty of the King of Magadha is reported to have been poisoned by a designing minister. Coming to the Mahomedan age, when intrigues were common both in the court and inside the harem, rivalry in love and political power contributed largely to the increase of cases of poisoning. The victims were either killed or deprived of intellect by the use of poisons less lethal in character. It does not appear to be true, as stated by some earlier European travellers and quoted by Chevers, that the burning of Hindu widows on the funeral pyre of their husbands originated in the fact that Hindu girls used to poison their husbands on the smallest pretext, and that this rite was enforced to put a stop to the practice. During the earlier period of the English Administration theft by administering intoxicating drugs became frequent and the practice prevails to this day, though to a much less extent. The historical records give but little information as to the poisons in use in ancient times, but shew that the poisoner's tradition in India dates back to a very early age. Sufficient has accordingly been now advanced to demonstrate, not only the present prevalence, but also the antiquity of poisoning in India. The statistics quoted are evidence that poisoning is unduly prevalent at the present time, murder by poison being thrice as prevalent, and suicide by poison apparently many times more prevalent than in England, where the sale of poisons is under legal restrictions. The conclusion is fairly logical that those measures which have succeeded in bringing about a reduction of poisoning in other countries may, *cæteris paribus,* be equally successful in India. The fact that the conditions are not the same in the two countries has already been referred to. But it will be seen when the nature of the poisoning in Bengal is reviewed, that the special natural conditions existing in India do not at the present time exercise much influence on the nature of the poisoning which takes place. It is, in fact, of the very kind to be successfully controlled by measures wisely conceived and prudently initiated. A plea much stronger than the statistics of their prevalence is to be found in the nature of the greater number of cases of poisoning which annually take place in the province.

B.—It will be observed as the description of the nature of these cases proceeds, that the users of poisons are very conservative in their application. Each poison has, as it were, its own rôle or specific use, and is comparatively but seldom employed for other purposes. Thus arsenic is the poison usually selected for murder and cattle destruction, opium is the poison with which to effect suicide, *datura* the drug with which to produce stupefaction, and thus facilitate theft, and so on. The poison selected is generally that which by long-established precedent has become the recognized means for effecting the desired purpose. The import or production of some of these poisons is already under the control of the authorities ; in the case of some of the others, however, which grow wild or nearly so, any effectual control will be difficult. From what has already been said, an account of the nature of poisoning cases resolves itself into a description of the classes of poisoning which occur, with the poisons which are generally used in each class. The cases can conveniently be arranged into the following seven classes :—

I.—Murder by poison.
II.—Administration of stupefying drugs in order to facilitate theft.
III.—Administration of poison to effect destruction of the intellect.
IV.—Administration of poison to effect abortion.
V.—Cattle poisoning.
VI.—Suicide by poison.
VII.—Accidental poisoning.

Each class will be dealt with in turn, with special reference to the poison most frequently used in each class. A few fairly illustrative cases will also be cited by way of demonstrating the methods of administration.

I.—Crime of this kind is rare in England ; and the facilities for detection and difficulties of concealment are such that the statistics may be regarded as highly reliable. It is hardly possible to assume the same confidence with regard to the available returns in Bengal, for not only are the facilities for detection less, but the possibilities of concealment much greater. In India the symptoms of natural disease and the effects produced by poison simulate each other to an extent quite unknown in England, occasionally baffling even experienced medical men. The fact that notwithstanding difficulties of detection, *murder by poison* is three times more prevalent in Bengal than in England, sufficiently indicates an unsatisfactory state of affairs. The circumstances attending specific instances of poisoning illustrate this more fully. In England it is almost impossible for an individual during a sudden fit of passion to be able to obtain and administer poison to those with whose conduct he or she is incensed. For unless the circumstances were special, such an individual could only procure sufficient poison for his or her purpose after the lapse of a period of time sufficient probably for reason to have regained control of anger. Such cases, however, do occur in India. We can adduce instances the occurrence of which can only be attributed to the ease and rapidity with which the poison was procured. Thus in 1893 the youngest brother in a high caste Brahmin family, residing in the vicinity of Calcutta, having had some misunderstanding with two of his elder brothers quietly entered the kitchen and mixed powdered white arsenic with some common salt lying there for immediate use. A curry was prepared with the poisoned salt and eaten by several members of the family, all of whom developed symptoms of irritant poisoning. Fortunately, the quantity of salt used was small, and but little of the curry was partaken at the particular meal. The victims all recovered. The common salt, the curry, and the vomit of some of the affected persons were sent for examination. Arsenic was detected in all of them. The culprit is still at large. Such cases can be multiplied, but the example given is a typical one of its kind. Typical, too, in many ways, in the absence of premeditation, the method of administration, and the selection of the poison. The two poisons most readily attainable are probably opium and arsenic. The former is not suited to the murderer's purpose, for its appearance and taste might lead to its early discovery. White arsenic, on the other hand, is tasteless, and powdered and mixed with common salt would readily escape detection.

Classified according to the motive, cases of murder by poison in India can easily be arranged into types equally familiar in all countries. Thus in India, as in other countries, revenge, jealousy, lust, greed and avarice may any one of them instigate the act. The motives are the same everywhere. Have they borne more fruit in India, and, if so, why? The poisoner's art is probably older in India than among the modern nations of Europe; and it may be argued that use has begotten use till familiarity with the nature and effects of poisonous drugs has become very general. It is much to be doubted whether at any time in England uneducated people possessed the acquaintance with poisons which belongs to certain classes among the poor and uneducated masses in India to-day. Such poisons as they knew, and knew well, were fortunately less potent. We do not mean to suggest that the criminal class is proportionately larger in India than in England, for we believe that it is not; but it would appear that a sense of the value of human life has taken a stronger hold of the masses in England than in India. The smaller appreciation of the value of human life in India may possibly have originated to a certain extent in her religious teaching, which tends to exalt the value of a future existence at the expense of the estimation in which, present temporal and material possessions, and even life itself, should be held. Then her teeming population and the struggle for existence with the thin margin which separates many millions from difficulty or want may serve to have accentuated a tendency which, while harmless on the part of non-criminal minds, becomes dangerous among the criminal classes. The feeling regarding human life which exists in England to-day did not always exist. It has taken many years to develop. Time and the spread of education will, it may be hoped, engender a similar sense among the masses in India. We have referred to those acts of poison administration which resemble acts of homicidal violence during the heat of passion, and which probably are often followed by as speedy a repentance. But besides cases of this kind, a very large number occur annually where the poison has been administered after long premeditation and with deliberate intent. Our paper is intended to demonstrate the need for legislative interference with the free sale of poisons in India and for the enactment of laws regarding the possession of poisons by individuals in this country similar to those in England. If such measures are to be successfully introduced, cognizance must be taken of all the circumstances special to India. It would naturally be supposed that cases of deliberate poisoning, premeditated during a considerable period of time, are those which can be dealt with least effectively and with the greatest difficulty. The poisoner has time, and may be opportunity, to select a poison the detection of which is difficult. Does he do so? Experience shows that he seldom attempts any thing of the kind, but utilizes the one well-known poison, *viz.*, arsenic. Scientific poisoning is practically unknown in India. As a rule, large quantities of poison are administered, and whether the act be sudden or long premeditated, the one poison commonly chosen to effect murder is the easily detected poison, *arsenic*. We will cite a case of long premeditated and determined murder by poison which occurred in 1893 to illustrate the point. A Sikh, named Rajah Singh, the prospective heir to some property, had a long-standing dispute with some of his co-religionists regarding the estate. Taken one day by one of these men, Jowhir Singh, to the Sikh temple in Burrabazar, he was given *Karaprasad*, a sweetmeat, sacred among the Sikhs, to eat. While eating it Rajah Singh objected to the taste, and protesting that it was not the real *Karaprasad*, but the ordinary sweetmeat or *halua*, wanted to eject it from his mouth. He was, however, persuaded to swallow the sweetmeat, on the ground that, as a true Sikh, he ought not to insult the *Karaprasad*. Shortly after he left the temple to return to his house, he became very ill on the road and vomited once. On arriving at his house he became very ill, suffering from vomiting and purging. Suspecting that he had been poisoned, he communicated his suspicions to his mother and other relatives. He was then taken to the Medical College Hospital, where his stomach was washed out, and where he made the above statement to the medical officer on duty. Next day he died. The stomach washings and viscera were sent to the Chemical Examiner for analysis and arsenic detected in both of them. Here avarice was the motive. Very frequently the motive is lust. Thus, during 1881, a case was referred from Cooch Behar, in which a faithless wife poisoned her husband with arsenic, and afterwards married her paramour. Arsenic has occasionally been used by step-mothers to remove unsatisfactory step-sons. In May 1884 Charcoo Nasya, a Mahomedan lad, aged 19 years, died at Dinagepore with symptoms of vomiting and purging, after partaking of food given him by his step-mother. Arsenic was detected in the vomited matters and also in the viscera. In cases of murder by poison, white arsenic is chiefly used, yellow arsenic occasionally and red arsenic rarely. *Darmuj* and other arsenical preparations are very rarely employed. As will be shown later on, the greater quantity of arsenic in the country has been imported by sea. The quantity naturally available in India is very small; yet to-day the drug is to be found everywhere. How then has its dissemination and the knowledge of its properties become so general? The question is interesting, and not entirely speculative; for it might be possible from such data to ascertain the period of its rise into favour as a poison. We have stated that arsenic is the poison most frequently used to effect murder. A definite statement, giving the percentage of cases of murder by poison in which arsenic has been the poison selected, ought to be forthcoming. Unfortunately, no such statement is available. The Chemical Examiner's reports show in what proportion of fatal cases of poisoning of all kinds arsenic has been detected, but the cases cannot be classified with any certainty by the Chemical Examiner from the information supplied to him. Next in frequency of use to arsenic comes *aconite*. The following is a typical case of aconite poisoning: On 6th May 1891, three coolies, of the *Chamar* caste, were found lying dead in the Dhurrumtolah market; two others were unconscious, but subsequently recovered. The investigation showed that all five men had been poisoned with aconite mixed in their food by one Jeetoo Chamar at the instigation of Sunnoo Chamar. All concerned were fellow-countrymen, and had been friends up to the time of the act, the cause for which apparently consisted in the fact that one of the murdered men had a quarrel with Jeetoo Chamar, who thereupon introduced poison into the common meal of five individuals, with four of whom he was not in any way at variance. No example could be more striking of the recklessness of the prisoner, on the one hand, or, on the other, of the small provocation required in some instances to induce the act. Besides *arsenic* and *aconite*, preparations of *mercury*, *copper*, *antimony* and *nux-vomica* are occasionally, though rarely, used for the purpose of murder. The smell and other physical characters of opium are effectual obstacles to its frequent employment for murder. It is used, however, to effect infanticide, and sometimes is given in wine to drunken individuals to effect murder. On one or two occasions of late years, the alkaloids—*strychnine* and *morphine*—have been employed. The method of administration is that in use from time immemorial, *viz.*, of mixing the poison with the food. Thus yellow arsenic can be fairly well concealed in *dâl*, curry, and white arsenic in common salt. All articles of food are utilized. If the poison be tasteless, or nearly so, and well concealed in the food, the better is it taken by the victim.

II.—This class of crime is but little known in Europe. In India it is very frequent. The police returns for the province of Bengal show that twenty-three cases of administration of stupefying drugs to cause hurt occurred in 1893. The drug almost universally employed is *datura*, well-known as the *thug* poison, since those of the *thug* gangs, who were not adepts in the use of the sling, employed *datura* to drug their victims, and subsequently robbed them when helpless. The history of one instance of *datura* poisoning is practically the history of all of them. A stranger joins a party of individuals on a journey, and wins their confidence sufficiently to be allowed to cook or prepare their food, into which he introduces powdered *datura* seeds. On one plea or another he excuses himself from partaking of the common meal, which is eaten by the remainder of the party, who succumb to the influence of the drug, and are easily robbed. Robbery by means of *datura* is almost a profession, and many of those who practise it display considerable dexterity in the method by means of which the admixture of the poison with the food of their victims is carried out. The use of a hollow pestle filled with powdered *datura* seeds, and having a small orifice at the lower end, is sometimes resorted to. The pestle is employed to grind the pepper and other condiments for use in cooking the food, and the drug is thus successfully introduced therein without even exciting the suspicion of the victims. The employment of *datura* is probably encouraged by the popular belief that it produces unconsciousness only and not a fatal result. The use is for the purpose of making robbery easy and of avoiding violence. Murder is not the object, but the reverse. The administration frequently, however, results in murder, as the following record will show: In July of this year (1894) at Monghyr, *datura* was administered to the crew of a boat numbering eight persons, one of whom subsequently died from the effects of the drug. The robbers got off with their booty. As the case is typical, the following account furnished by Surgeon-Major D. G. Crawford may prove interesting: "Two men took a boat at Sonpur to carry them to Narainganj. On the evening of the 22nd July the boat was tied up for the night at Gogri opposite Monghyr. The crew, consisting of seven men and a boy (son of deceased), took their food as usual about 9 or 10 P.M. They went to sleep. Next morning they were all found insensible, and one died about noon. The other seven were sent to Monghyr where they arrived at about 2 P.M. to-day (24th July). I saw them at about 4 P.M. All had somewhat dilated pupils. One talked somewhat incoherently, the rest appeared to have fully recovered. All their property had disappeared; so had the two passengers who are supposed to have mixed drugs in their food for purpose of robbery. The two passengers being of a different caste did not eat with the crew." In most cases of *datura* poisoning, the whole fruit or powdered seed is administered mixed with solid food. In such cases, fragments of the seed can frequently be detected on microscopic examination in the vomited matters, the excrement, and in the food. Occasionally, though not frequently, spirituous liquors are made the vehicle for the administration of the drug. During the current year a case occurred in which *datura* was administered in this manner. A prostitute was visited by a man, who, in the course of the interview, offered the woman some country liquor to drink, and in proof of its character drank some himself. After drinking the liquor, the woman became unconscious, and the man with whom she had had no previous acquaintance, having stripped her of her ornaments, tried to decamp. In this case *daturine* was extracted from the country liquor, from the stomach washings, and from the excrement of the poisoned woman, as well as from the stomach washings of the accused. As already stated the employment of *datura* is almost invariably for the purpose of facilitating theft. One instance, however, occurred during the current year (1894), where it was administered to facilitate the murder by violence of a Hindu male, sixty-five years of age.

This man had two wives, of whom the younger, Matangini, had contracted an intimacy with another man. The husband objected to his wife's misconduct, in which however she persisted, notwithstanding an occasional beating at the hands of her husband. On May 30th, instigated by the woman who arranged the interviews with her paramour, Matangini mixed a whole *datura* fruit in the curry which formed her husband's meal. When the husband had become unconscious Matangini killed him with a *dao*. On the discovery of the dead body, the murderess made a full confession of her crime.

III.—Such cases of the crime as might come to the notice of the authorities would, no doubt, be included under the heading of the administration of stupefying drugs to cause hurt. The drug employed is almost always *datura*. But little is known regarding the crime, and the production of specific instances is impossible. It is carried out secretly and very gradually so as to simulate the natural course of mental disease and to excite the suspicion neither of the victim nor his friends. It is stated that women administer *datura* to their husbands in this manner, in order to obtain opportunity for the successful prosecution of love intrigues; and that prospective heirs to large properties are thus deprived of reason by individuals interested in the succession, as under Hindu law insanity is a bar to inheritance.

IV.—The average annual number of cases of *abortion* reported in the Bengal Police Administration return for the years 1888 to 1892 was 24. It is not stated whether these are cases of simple abortion or death, the result of the attempt. In none of these years either was any case reported as having occurred in the town of Calcutta. The small number of the cases reported for the whole of the province, and the fact that none are reported from the town of Calcutta, may be taken as almost sufficient evidence that a small number only of the cases that actually occur ever come to light. A practice in procuring abortion is carried on by certain women of low caste, who occasionally administer sufficient poison to their clients to effect a double murder. These women frequently pass themselves off as midwives. The method generally employed is the introduction into the cervix uteri of the stems or roots of plants which possess irritant active principles. Thus plumbago rosea (*lalchitra*), nerium odorum (*karubi*), calotropis gigantea (*akand*), euphorbia tirucalli (*lankasij*) and others are utilized. Sometimes bamboo sticks, coated with assafœtida, are introduced to effect the purpose. The violence used together with the local action of the drug occasionally sets up hæmorrhage or septicæmia ending in a fatal issue and the discovery of the crime, Now and then drugs are internally administered in the attempt to procure abortion, and have been found after death in the viscera of women who have died as the result of the attempt. Arsenic, yellow oleander, colocynth, plumbagin (the active principle of *lalchitra*), and other poisons have been detected in the viscera in such cases.

V.—The degree to which suicide prevails throughout the province of Bengal has already been dealt with. It has been pointed out that there is every reason to believe that suicide is on the increase, at any rate in Calcutta and other large towns. Part of this apparent increase may be due to the better system of records now in vogue in Calcutta; but it can hardly account for the total increase which the figures indicate. Thus the total suicides from all causes in Calcutta town and suburbs, which were 84·94 per million per annum for the five years, 1876 to 1880, had swollen to 123·52 per million per annum during the five years, 1889 to 1893, shewing an increase of 38·58 per million. This fact is serious, and becomes more so when it is understood that of the total increase of 38·58 per million, suicide by poison accounted for 32·42 per million. Of the total suicides occurring annually in the town and suburbs of Calcutta, 40 per cent. are accomplished by taking opium, arsenic is selected in 5 per cent. of the cases, and other poisons not indicated in 11 per cent.

Among the populution dwelling in the municipal area of Calcutta during the year, 1st June 1893 to 1st June 1894, 52 deaths by poison occurred; of these 44 (all suicidal) were due to opium or 84·6 per cent.* The facts then that claim attention are the following, *viz.*: (*a*) That the crime of self-destruction has enormously increased during the last ten years, and that the cases which have produced the increase are almost entirely those of suicide by poison; for while during the five years, 1876 to 1880, the average of suicide by poison to the population was 36·42 per million, in the period, 1889 to 1893, it had risen to 68·84 per million, or nearly double.† (*b*) Of one hundred cases of suicide occurring in the town and suburbs of Calcutta, 56 are due to poison; and of the 56, in 40 opium has been the poison taken, in 5 arsenic, and in 11 other poisons. It is well recognized by the writers of this paper that the conditions of life existing in the town of Calcutta find no counterpart in the rural districts of the province, and only to a limited extent in the large towns at the present time. Still as increase in the crime may be regarded as the outcome of unhealthy social conditions,

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* Dr. J. B. Gibbons informs us that of the 52 cases of poisoning in which he made a *post-mortem* examination, 44 were due to opium, 1 to sulphuric acid, 5 to arsenic and 2 to hydrocyanic acid.

† Suicides from all causes in the town and suburbs of Calcutta :—

During the period,	1876—1880 ...	84·9	per million per annum.
Ditto	1889—1893 ...	123·52	" "
	Increase ...	38·58	

Suicide by means of poison throughout the same area :—

During the period,	1876—1880 ...	36·42	per million per annum.
Ditto	1889—1893 ...	68·84	" "
	Increase ...	32·42	

and as the social conditions existing in Calcutta must sooner or later prevail in all the towns of the province, and at some remote period in the rural districts also, it would be interesting to enquire what those social conditions are in which an explanation of the increase in the crime of suicide must be sought.

Except in a certain proportion of those cases where suicide is resorted to in order to escape the extreme penalty of the law, it is justifiable to regard all cases of self-destruction as the result of a temporarily or permanently unsound mental state. A healthy mind in a healthy body is probably the greatest of earthly blessings. Their varying conditions mutually interact, however, to the impairment or otherwise of their individual functions. Thus the physical conditions of the dwellers in large towns are often such as to interfere with healthy mental action and development. A diseased or unsound state of mind may be permanent or temporary, may arise from the exaggerated development of certain mental attributes, or from a deficiency in the development of others. It may be organic lesion or functional derangement only, and may proceed from over-strain, from vicious habits of life, or from over-indulgence as the addiction to the excessive use of alcohol or Indian hemp and other drugs. In a large population there is always a certain proportion of mentally weak individuals, in whom the condition either exists as a congenital defect, or has become developed as the temporary or permanent result of circumstances. In the case of such individuals, self-control is weak or deficient, and imagination not habitually kept in check by the higher mental faculties. When a community is affected by any social wave or change, these are the members of the community, who, as a rule, display the most evident symptoms of the movement, acting as it were the part of social weathercocks. They are the most ready to adopt new phases of thought, and to sever themselves from their ancient religion and traditions. The religious system of a country is for the most part calculated to support its social fabric, to assist the individual in maintaining moral and mental self-control, not only in times of prosperity, but also in times of adversity. It may be noted in the histories of nations that, when the influence of the national religion is weakened from any cause, a measure of social convulsion often ensues. The extent and nature of the social movement must depend upon the natural mental calibre of the country, if outside influence be excluded. At the present time, in Calcutta and other large towns of India, a social movement of the kind referred to is taking place chiefly among the younger members of the community, who seem to be emancipating themselves from the tradition and influence of their ancient religion. Those among them less mentally robust than the majority are thus deprived, not only of that support which religious belief affords to weak wills, but also of the influence which the doctrines of their religion exert. Thus, as regards suicide, the *Shastras* inculcate that there is no salvation for the individual who has destroyed his own life. In former times, the Hindu placed implicit faith in the *Shastras*, but his descendants are in many instances falling away from the belief. The modern Hindu is more an artificial than a natural product. Furnished even in his own country with a foreign education and living within touch of a foreign system of civilization, he has, in many cases, lost the patience and resignation engendered by his ancient creed to gain instead imaginary wants and wild aspirations improbable of realization. Such influences acting upon any minds not absolutely sound are prone to produce outbursts of one kind or another on small provocation. A hypersensitive condition is induced and events quite insufficient by themselves upset a feeble mental balance and give rise to such an exaggerated estimate of even trifling troubles that self-destruction is resorted to.

The exciting causes which, acting on an unhealthy mind, induce suicide are the same in every country. Ill-treatment, quarrels, jealousy, despair, destitution and physical suffering, all can claim their victims and among both sexes. But in Bengal, as in England, the incidence of suicide is unequal in the two sexes. In England the male sex furnishes the larger number of cases ; in Bengal the female, according to the Sanitary Commissioner's reports. It has been shewn that suicide has increased of late to a painful extent among the Hindu population of Calcutta. The cases that occur are of all kinds. Thus merchants on pecuniary reverse, students failing to pass their examinations, disappointed suitors, wayward sons checked by their parents, and unhappy girl-wives, all attempt to find in suicide an escape from their real or supposed misfortunes. The minds of the young, possibly the women chiefly, do not acquire a healthy tone from the perusal of the sensational worthless novels now being published in large numbers by the vernacular press of Bengal. We presume that every one now-a-days admits that persons who attempt or commit suicide should in most instances be regarded as either permanently or temporarily irresponsible for their actions. They are, therefore, legitimate objects of care to the legislator according to the modern conception of civilization ; and since the easy accessibility of poison is responsible for a large number of suicides, it is this very easy accessibility of poison which should first be dealt with by legislative interference. Opium has been shewn to be responsible for the majority of cases of suicide in the municipal area of Calcutta, whether by violence or otherwise ; and opium is to be found in any quantity everywhere throughout the country. Other poisons are also used, and among them some, the introduction of which into the country is only of recent date, and due to the development of certain trades, such as photography and electro-gilding. By this means, *cyanide* of *potassium* has become known and has been employed in one or two cases. The extensive development in the trade of European drugs has familiarized many among the educated classes with their qualities and led to their employment also to effect suicide. As already stated no figures are available to show what proportion of the suicides reported in the Sanitary Commissioner's Return is due to poisoning, or what was the nature of the poisons chiefly selected. It is accordingly very difficult to obtain any idea, not only as to the number, but also as to the nature of cases of suicide by poison occurring in the province outside Calcutta. The Chemical Examiner's report may, however, be accepted as representing the nature of human poisoning generally which prevails in the province, although it does not profess to be a complete numerical return. If besides this our statement be accepted that, according to the account given by the forwarding officers, the cases in which opium had been detected were, for the most part, cases of suicide, then the figures given in the Chemical Examiner's report may serve to demonstrate the nature of the poison selected in cases of suicide by poison throughout the province generally. The results of poison detection in human viscera, forwarded to the Chemical Examiner during the past ten years, are given in the following table :—

TABLE III.

Shewing the percentage of poisons detected in human viscera during ten years ending 1893.

POISONS.	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893
Opium (including Morphia)	63·73	57·96	48·23	60·6	59·7	63·35	46·73	53·52	62·65	61·37
Arsenic	26·48	31·84	42·46	34·64	28·96	31·2	33·15	25·74	24·53	24·8
Aconite	4·81	3·72	·87	·95	Nil.	Nil.	4·32	8·07	4·6	5·87
Indigenous vegetable poisons, such as Nux Vomica, Datura, &c.	2·40	3·73	4·38	·95	2·01	1·96	3·27	8·07	3·32	3·72
Other poisons, such as Hydrocyanic Acid, Alcohol, Mercury, &c....	2·58	2·75	4·06	2·86	9·23	3·49	12·53	4·6	4·9	4·24

The information afforded by this table may be returned in round numbers as follows, that, taking the results of ten years as the basis for the calculation, opium and arsenic constitute 90 per cent. of the poisons detected. Opium by itself is the poison detected in 58 per cent. Then bearing in mind the statement already made regarding these cases of opium poisoning, this figure, *viz., 58 per cent.*, may be regarded as indicating the conditions influencing poison selection in cases of suicide by poison throughout the province.

VI.—The most cursory consideration of any record of cases of accidental poisoning must always produce the conviction that the term is almost a misnomer. It is rare to find an instance of accidental poisoning unassociated, either with culpable ignorance or grave neglect. There is an old adage regarding the care of edged tools, and surely such poisons as opium, aconite, nux vomica and arsenic are as dangerous as many edged weapons. Yet, if we are to be guided by our knowledge of actual cases, we must believe that to-day, in some humble households in Calcutta, a poisonous dose of opium is within the reach of children barely able to walk,—a want of parental forethought which is productive of cases of opium poisoning. The shops of the *bunniahs* constitute another danger, for they are the source whence all classes of the community, both European and native, either directly or indirectly through their servants draw their supplies of spices and condiments. The *bunniah*, besides selling spices and condiments, is a retail vendor of sago, barley, sugarcandy and indigenous medicine, both mineral and vegetable, together with a few European drugs. The *badia* (*badini*), with whom the general community are less concerned, sells fresh vegetable drugs only. Both *bunniahs* and *badias* are, as a rule, ignorant people, scarcely able to read or write their own language. Their knowledge of the properties or identity of the drugs they sell is very imperfect, and the manner in which the drugs are stored renders their ignorance almost criminal. In a *bunniah's* shop even the poisonous drugs are generally kept in unlabelled earthen "*handies*," which may happen to be in close proximity to harmless drugs, spices and condiments. From memory and practice the *bunniah* is usually able to sell his wares without mistake, but should the position of the pots be changed without his knowledge, most serious accidents may arise. On one occasion a customer was supplied with strong nitric acid in place of spirits of wine, and on another nux vomica bark *(kuchila)* was supplied instead of Wrightia antidysenterica (*kurchi*). The latter mistake caused the death of a child. Mistakes are occasionally made even by competent persons well acquainted with the nature of the drugs they vend. A mixture of santonin and strychnia was once supplied at a chemist's shop to a customer in place of santonin, and on another occasion the proprietor of a Medical Hall, addicted to the use of opium, administered to himself, by misadventure or carelessness or both, a dose of extract of nux vomica, instead of his usual morning dose of opium. In both these instances the mistake was followed by a fatal result. Somewhat similar to the sale of drugs by ignorant *bunniahs* and *badias*, and quite as dangerous is the trade in secret preparations and quack remedies. This class of medicines finds a large and ready market among the poor and ignorant classes of the country, the sale no doubt being assisted by an eloquent, if untruthful, description of their origin and virtues. Instances are recorded of credulous peasants having been induced to believe that medicines bought by them from some of these unscrupulous vendors were obtained as a special favour from the gods. The medicines often contain poisons, and as they are prepared by ignorant persons, the dose is often, if not always, excessive. Many instances of poisoning produced by taking quack remedies are on record. Thus, in 1880, at Sibsagar, a woman took one of a number of pills sent to her from Calcutta with the recommendation that they were warranted to cure dysmenorrhœa, amenorrhœa, leucorrhœa, menorrhagia and uterine troubles generally. Within half an hour of taking the pill, well marked symptoms of strychnia poisoning were induced. The pillswere found contain strychnia. In 1882 a sepoy of a native infantry regiment was found to be in possession of some medicinal preparations by means of which to his own pecuniary benefit he had been in the habit of supplementing the regular medical treatment of his sick comrades. Some of the men thus treated developed symptoms of irritant poisoning, while others displayed symptoms of mercurial marasmus. On analysis the preparations were found to contain arsenic, antimony, and mercury. During the current year six samples of a stock of medicines which were in considerable request among the poor of Calcutta as cancer cures, etc., were referred to the Chemical Examiner for analysis. Four of them contained arsenic.

Certainly less creditable and possibly more criminal even than the foregoing is the class of cases of so-called accidental poisoning that we now propose to briefly consider. It arises from the use of charms, love philters, and of medicines administered with a view to excite the sexual passions. Charms and love philters are in common use among the ignorant people of the country, and, though for the most part, they are harmless preparations of betel and different kinds of root fibre, yet occasionally they are compounded of poisonous drugs, such as aconite, arsenic and datura. As a consequence an undesired and unforeseen fatality occasionally results from their use. Thus, in 1884, a man unintentionally poisoned his wife, a young girl only 14 years of age, by giving her a so-called love philter mixed with sugar. The girl disliked her husband, and was in the habit of deserting him. The love philter which contained arsenic was administered by the husband apparently in the honest hope that he might thereby gain his wife's affections. Allied to the administration of charms containing arsenic and other drugs is the habitual use of arsenic by certain classes of people in India on account of its supposed aphrodisiac properties.

Up to this point we have dealt with accidental poisoning, only in so far as it arises from the use or misuse of poisonous drugs as such ; but cases of accidental poisoning also arise from the introduction, for the most part through ignorance, of improper substances into foodstuffs. As an example of this may be cited the colouring of sweets with poisonous pigments by the ignorant sweetmeat sellers of the country. The pigments discovered to have been used in this way are yellow arsenic, verdigris, Scheele's green, chromate of lead, magenta, and other aniline dyes. Cases of this kind are well within the reach of police interference, and it must be said are generally prevented in Calcutta. Occasionally also a poisonous vegetable substance due to some mistake as to its identity is prepared and eaten as food. The following case occurred in 1893 and is an interesting example of the kind : Some individuals near Dacca made a curry of a tuberous root which they had obtained from a neighbouring jungle and mistaken for "*matia aloo.*" After partaking of the curry, "they became intoxicated and vomited, remaining insensible for six hours. They then regained their senses." On analysis the tuber and the curry were found to contain a violent irritant and narcotic poison. Neither the tuber nor its active principle have yet been identified. Cases of this kind are, however, rare and present a marked contrast to the majority of instances of so-called accidental poisoning most of which are at least culpable, if not criminal.

VII.—A glance at the following table will shew at once the nature of the cattle poisoning which takes place. Its undue prevalence has already been considered :—

TABLE IV

Shewing the percentage of arsenic detections in animal viscera and in substances sent for examination as cattle poison during ten years ending 1893.

	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893
Animal viscera..	100	100	100	100	100	100	100	100	100	100
Cattle poisons ..	..	92·59	96·4	92·35	95·78	94·73	93·66	92·36	93·18	92·5

Practically arsenic is the sole poison employed for the destruction of cattle. It has many advantages over other poisons. It is tasteless, certain in its action, and the dose required is small. Further, the hides of animals poisoned with arsenic are more easily preserved. The method of administration is as follows : A small quantity of white arsenic is made into a paste with flour, oil or oil-cake, and then wrapped up in plantain or other leaves and thrown before cattle grazing in a field, or introduced into the manger among the fodder. The seeds of abrus precatorius, croton seeds, and yellow oleander are also used as cattle poisons, though but rarely, in Bengal. The seeds of abrus precatorius are made into a paste, which is dried and then fashioned into a miniature arrow head, about 1-inch long and $\frac{1}{8}$th inch in diameter at the base, constituting in this shape the well-known "*sui* poison." The "*suis*" thus prepared are forcibly introduced through the skin of the animal to be poisoned. In the Punjab similar "*suis*" are prepared with arsenic in place of abrus precatorius seeds. Though cattle are occasionally poisoned to satisfy a grudge, the more usual object is the possession of the hide. The poisoners are a class of people known as *Chamars*, who, in return for their services in skinning cattle, are allowed to claim a percentage of the profits derived from the sale of the hides. The destruction of dumb animals, which at present prevails in India, is not only accompanied with much physical suffering on the part of the animal, but it is also unnecessary. If fresh supplies of poison be cut off, with the gradual exhaustion of the stock of arsenic existing throughout the country, a diminution in this class of crime may confidently be expected. The measures proposed for restricting the supply of arsenic will be dealt with later in detail.

By the consideration of the prevalence and nature of the poisoning in the province of Bengal at the present time, we have shown the necessity for some measures calculated to bring about a reduction of the present prevalence. The measure which naturally commends itself, and which has been successful in other countries, is that usually described as a restricted and regulated sale of poisons. Accordingly, we now pass to the consideration of the best and most feasible means for restricting and regulating the sale of poisons in Bengal.

C.—As recommendations having the same object in view have frequently been made during the past half century, it would be as well to refer to these first, and then deal with the scheme now proposed. Accordingly, our remarks concerning measures proposed for restricting the sale of poisons are easily arranged into the following three sections :—

(1.) Previous recommendations and their outcome.

(2.) Proposition now under discussion.

(3.) Difficulties attending the introduction and working of such a measure, or briefly its *pros* and *cons*.

1. From the year 1843, when Dr. Mouat drew the attention of Government to the matter, up to the present time, the recommendations to control the sale of poisons have been numerous and frequent. Some of these will now be reproduced. Thus, in 1856, Dr. Mouat's contention was supported by Dr. Chevers, who then wrote as follows :—

> "It certainly appears to be a matter of great importance that the importation, or at least the sale, of *arsenic* in India should be regulated by stringent legislative enactment. *There is no law in India prohibitory of the sale of poisons.*"

The experience of medical officers in Madras corroborated that of medical officers in Bengal; for in 1879 the Surgeon-General and the Chemical Examiner to the Government of Madras submitted the following statement to their Government. The Chemical Examiner in his report states that—

> "Arsenic is far more frequently used than any other poison. Attempts at poisoning with other poisons unless accidental have probably rarely succeeded. There can be little doubt that in this Presidency, the determined poisoner is pretty sure to make use of some arsenical compound. The destruction of human and animal life by this poison is so considerable that some restriction upon the sale of arsenic is from the medico-legal point of view highly desirable."

When forwarding the Chemical Examiner's report, Surgeon-General W. R. Cornish, F.R.C.S., C.I.E., recorded the following views :—

> "In passing on this report to Government, I feel that I should be wanting in my duty if I did not bring prominently to the notice of Government that the experience of the Chemical Examiner's Department shews most conclusively that the poisons resorted to by the people of India for criminal purposes are mainly common arsenical preparations or mercurial salts, and that no restriction whatever is placed on the sale of such things in this part of India. I have no doubt that if some wholesome restriction was brought to bear on the trade in arsenical and mercurial preparations, and in some of the more common organic poisons, the crime of administering poison would be less frequent and more easy of detection than it now is, and I venture to hope that the Government may be prepared to deal with the question having for its object the restriction of the sale of poison in the Presidency. It is not creditable to our administration in this particular that, within the last year, no fewer than three persons in the town of Madras should have been enabled to commit suicide by purchasing at druggists' shops, without let or hindrance, quantities of chloral hydrate sufficient to cause death."

The necessity for restricting the indiscriminate and irresponsible sale of poisons, specially arsenic, was frequently dealt with by Dr. Warden, the late Chemical Examiner to the Government of Bengal, in his annual reports. The following remarks appeared in the report for 1882 regarding cattle poisoning :—

> "Arsenic is the poison generally used. Enormous quantities are found in the parcels of suspected cattle poison sent for examination. In one case one pound of white arsenic was found in two packets. It has been urged that any special legislation to restrict the sale of poison would be useless, because indigenous vegetable poisons are to be found in every hedgerow. This is a fallacious argument. Because vegetable poisons happen to be common, it does not follow that arsenic is to be picked up in roads and ditches. Arsenic is *par excellence* the poison used for criminal purposes in India. If it is impracticable to restrict the sale of all poisons, the indiscriminate vending of arsenic might be diminished by levying on it a prohibitory tax which could place it beyond the reach of the masses. The legitimate uses of arsenic in this country are not numerous, and for the purposes of certain trades it might be issued duty-free, but under the most stringent restrictions."

Dr. Waddell, while officiating as Chemical Examiner in 1884 during the absence of Dr. Warden, referred to the necessity for legislative action, similar to that existing in England, in the following terms, which were noticed by Government in an interesting resolution, also reproduced :—

> "The necessity for the imposition of certain restrictions on sale of poisons has on more than one occasion been represented, and has attracted the attention of the Government. The Lieutenant-Governor in the resolution on the report for 1882-83 said that 'the general question as to the imposition of restriction upon the sale of poisonous drugs demands, and will receive, separate consideration.' But up till this time no steps have been taken in this direction. The restrictions in force in England work without trouble to the authorities there, and it is reasonable to suppose that in India as in England increased difficulty of access would soon render the use of poisonous drugs less frequent."

Government resolution on Dr. Waddell's report :—

> "The question of the restriction to be imposed on the sale of poisonous drugs has been more than once under the consideration of the Government. It is beset with many difficulties. Poisonous substances exist in every hedge and garden throughout the country, and in the present state of society in Bengal it seems quite impossible that the sale of poisons generally can be effectually controlled. What is more important is to check the ignorant compounding of English drugs and medicines. With this object provision has been made in the Bengal Municipal Act, 1884, for the registration of shops for the sale of European drugs and for the employment in them of dispensers duly certified as fit persons to be entrusted with such duties."

In 1886 Dr. Warden thus commented on the above resolution :—

> "It is true, as was pointed out in the resolution on the Chemical Examiner's report for 1884, that the subject is beset with many difficulties. But there does not appear to be any valid

> reason why an attempt should not be made to restrict the sale of some, if not, all poisons. The state of society in Bengal is hardly likely to change materially for a few centuries. A complete bill, similar to the English Poison Schedule of the Pharmacy Act, it is Utopean to anticipate for India. The provision in the Bengal Municipal Act, 1884, for registrations of shops for the sale of European drugs is apparently intended to check the ignorant compounding of English drugs and medicines by unqualified druggists and for the registration of shops for the sale of European drugs. But this legislation, though highly desirable, is surely less important than some enactment which would prevent *bannias* and native drug-vendors from indiscriminately selling arsenic to anybody who can afford to purchase it. The provision of the Bengal Municipal Act protects to some extent the European community and the higher educated classes of the natives. But the lower classes, most in need of protection, are not benefited."

In 1887 Dr. Warden again wrote as follows :—

> "The increase for the last two years in the number of cases in which arsenic was detected in suspected articles, when taken into consideration with the fact that a similar increase is also apparent for the same periods in the number of cases in which arsenic was detected in human viscera, points, in a most unmistakeable manner, to the desirableness of speedy legislation to prevent the indiscriminate sale of poisons. Obviously no enactment would prevent individuals with a suicidal mania from destroying themselves with poison if so disposed. Legislation is required to prevent the use of poison for homicidal purposes, and the one poison which is used in India for this purpose is arsenic."

The matter has also attracted the attention of the "British Medical Journal." The following is an extract from an article, published in the October number of 1892, dealing with the free sale of poisons in India :—

> "We have from time to time called attention to the great danger to the public and the serious encouragement to the criminal tendencies occasioned by the unrestricted traffic in deadly poisons in India. We are aware of the old argument of those who counsel non-interference, *viz.*, that in a country where deadly herbs grow on every roadside and open space, it is impossible to prevent their improper use. But the argument scarcely applies to the wholesale and retail dealings in *white arsenic*, which we understand can be bought without let or hindrance, or any record of the sale or purchase, in every village bazar throughout the country. The Chemical Examiners to the various Governments invariably shew that in about three-fourths of the cases in which poison is used with criminal intent, the article selected is *white arsenic*, not only for putting away of obnoxious individuals, but for the destruction of the cattle as well."

Such then are some of the recommendations which have been made from time to time during fifty years. What has been the result ?

The result so far has been the passing of certain sections of the Bengal Municipal Act of 1884 and of the Calcutta Municipal Consolidation Act. For convenience of reference these two sections are given in the foot-note below.* They secure, as already stated on page 4, that all shops engaged in the retail trade of British Pharmacopœia drugs should be registered, and that the compounders employed in these registered shops should be properly qualified.

No objection of any kind can reasonably be advanced against an Act directing the registration of shops engaged in the sale of medicines and the employment therein of properly qualified persons. Measures of this kind are enacted, not only in order to obtain the accurate compounding of medicines, but also in order to avoid those mistakes which arise from errors in the identification of drugs. No doubt the operation of the Act in question has been to greatly minimise the risks arising from ignorant or careless compounding, so far as the majority of the British Pharmacopœia drugs are concerned. But the number of people benefited thereby is comparatively small. For even in the towns a very large proportion of the people, when sick, are treated by means of indigenous medicines. It would naturally be surmised that the sale of all medicines ought to be attended with a certain amount of care. Why then are indigenous drugs exempted from the operation of the Act? A poison does not cease to be a poison because it happens to be excluded from the British Pharmacopœia. As already stated, the Act applies to British Pharmacopœia drugs only. There are, however, certain drugs common both to the British Pharmacopœia and to the indigenous list, among them being *aconite*, *nux vomica* and certain *arsenical* and *mercurial preparations.* The drugs common to both lists are specially exempted from the operation of the Act, provided they are not sold in shops where British Pharmacopœia drugs are dispensed on prescription. One is prompted to ask whether such drugs, as *aconite* and *arsenic* change their character with change of locality, and whether they cease to be dangerous when dispensed without the help of a prescription. The special exemption of indigenous drugs from the restrictions imposed by the Municipal Act was, no doubt, made with the wise object of interfering with the practice of indigenous medicine as little as possible. But the practice of indigenous medicine does not consist solely in the administration of poisons, and it will not be interfered with if the sale of deadly poisons is entirely removed from the hands of the ignorant *bunniahs* and *badias* and entrusted, where necessary, to the practitioners of indigenous medicines themselves. The provisions of the Act, in

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* Bengal Municipal Act, Section 252.—"No shop or place shall be kept for the retail sale of drugs recognized by the British Pharmacopœia not being also articles of ordinary domestic consumption, unless the same shall have been registered in the Office of the Commissioners Any keeper of such shop or place failing to register the same within two months after the section shall come into force, or within two months from the date of the establishment of such place, shall be liable to a fine not exceeding one hundred rupees. The Commissioners shall, upon registration, grant the keeper of such shop or place a license, which he shall be bound to display in some conspicuous part of his premises.

No person shall compound, mix, prepare, dispense or sell any drug in any such registered shop or place, unless he be duly certified as a fit person to be entrusted with such duties under rules made for that purpose by the Local Government :

Provided that the provisions contained in this second clause of the section shall not come into operation until after the expiration of a period of six months from the publication of a notification to that effect in the *Calcutta Gazette* by the Local Government.

Nothing contained in this section shall be construed to apply to the sale of drugs used by practitioners of indigenous medicines, whether recognized by the British Pharmacopœia or not, when such drugs are not sold in a shop or place where medicines recognized by such Pharmacopœia are dispensed on prescription."

Calcutta Municipal Consolidation Act, section 368.—"No shop or place be kept for the retail sale of drugs not being also articles of ordinary domestic consumption, unless the same shall have been registered in the office of the Commissioners. Any keeper of such shop or place failing to register the same within two months of the passing of this Act, or within two months from its present form, are difficult to enforce, as it contains no schedule of European drugs, which may be sold by *bunniahs* on the supposition that they are utilized in the practice of indigenous medicine. It is reported that, as a consequence of this, a large sale of European drugs is carried on in some *bunniah's* shops. In Calcutta there is a very considerable wholesale trade in European and other drugs, in addition to the retail trade of the chemist's and *bunniah's* shops. The wholesale dealers reside chiefly in Burrabazar and Chandney, and carry on their business subject to no restrictions whatever. *White arsenic*, *chloral hydrate*, *hydrocyanic acid*, *morphine* and *strychnine* may be purchased at one of these wholesale dealer's shops in large quantity by any individual however unfitted to be in possession of poisonous drugs.

It may be said that the wholesale purchase of medicine, even for domestic use in cases of sickness, is the common practice among the educated inhabitants of the large towns of Bengal, provided no compounding is required. A private person, when directed by his medical adviser to take a certain medicine, or when taking a medicine on his own responsibility, usually purchases a considerable quantity at one time from a retail or wholesale druggist, without of necessity presenting a prescription. In such instances the dose is measured by the individual at his own home and not by the chemist. Provided the drugs bought and sold in this manner are not in any sense poisonous, no very serious objections can be raised to the plan, which is in addition apparently ratified by the approval of medical practitioners. But in the case of poisonous drugs no more dangerous plan could be imagined. For at the present time there is no law in India regulating the quantity of a poisonous drug which any single person may be permitted to purchase at one time, except in the case of opium where the quantity is limited to two ounces, or enough to poison, it may be, twenty individuals. Consequently individuals addicted to the use of *morphine*, *chloral hydrate*, or any other drug, find in India no difficulty in procuring any quantity of the drug for which they have acquired a craving. Needless to say, this is only one type of mischief resulting from the present system. If the wholesale druggist was permitted to sell poisons to authorized licensed persons only, and the retail druggist might sell poisons only on prescription, much of the mischief at present being wrought would be prevented. At the present time the retail druggist may do a wholesale business in poisons or other drugs without let or hindrance, provided he has the purchasers. Such being the present condition of the trade in drugs, notwithstanding the enactment of legislative measures, it may now reasonably be urged that these measures require amendment.

2. The measures we propose may be summarised as follows :—

(A.) An Arsenic Act. (B.) The amendment of those sections of the Bengal Municipal Act and Calcutta Municipal Consolidation Act which relate to the sale of drugs. (C.) The amendment of those sections of the Opium Act I of 1878 which relate to the retail sale of opium.

(A.) The Arsenic Act.—As already stated the *arsenic* in India is almost entirely imported into the country. By the courtesy of Mr. C. A. Samuells, Officiating Collector of Customs, Calcutta, we are enabled to furnish the following statement showing the imports and exports of arsenic at the Port of Calcutta during the last twelve years :—

TABLE V.

Statement shewing the quantities of Arsenic imported and exported into and from Calcutta, in the Foreign Trade, during the official years from 1882-83 *to* 1893-94.

Countries whence imported from and whither exported to.	1882-83	1883-84	1884 85	1885-86	1886-87	1887-88	1888-89	1889-90	1890-91	1891-92	1892-93	1893-94
	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.	cwt.
IMPORTS.												
From United Kingdom ..	669	50	546	427	77	314	303	253	402	255	522	330
„ Germany, Hamburg	..	..	..	..	...	..	..	...	20	..	11	137
„ China, Hongkong ..	19	27		15	12	7	21	41	88	53	15	113
„ Straits Settlements	39	198	445	19	42	80	102	288	20	192	295	205
„ Australia, Victoria	..	2	..	..	...	...	..	..	...	...	...	..
Total ..	754	377	990	461	131	401	426	582	530	500	843	785
EXPORTS.												
To Ceylon	..	13	13	..	.	..	..	..	..	..	..	6
„ Java	..	...	..	17	..	..	...	..	..	..	..	..
„ Straits Settlements..	226	34	70	175	106	161	154	119	..	195	60	127
Total ..	226	47	83	192	106	161	154	119	..	195	60	133

From the statement it will be seen that a very considerable quantity of arsenic remains in the country. Last year the quantity was thirty tons. The fatal dose of *arsenic* for an adult is two grains. How then, some might say, is the poisoning by *arsenic* to be prevented, when it is such a deadly drug and when such large quantities are annually imported. But thirty tons is a small quantity compared with the 2,875 tons which constitute the average annual output of *white arsenic* at the tin works of Tavistock in Cornwall ; yet fatal *arsenic* poisoning of

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the date of the establishment of such place, shall be liable to a fine not exceeding Rs. 100. The Commissioners shall, upon registration, grant the keeper of such shop or place a license, which he shall be bound to display in some conspicuous part of his premises.

"No person shall compound, mix, prepare, dispense or sell any drug in any such registered shop or place, unless he be duly certified as a fit person to be entrusted with such duties under rules made for that purpose by the Local Government.

"Any person not being a holder of such certificate, who shall compound, mix, prepare or sell any drugs, in any such registered shop or place, shall, on conviction before a Magistrate, be liable to a fine not exceeding Rs. 50 for each offence, and any owner, occupier or keeper of any such shop or place who shall employ any such uncertified person to perform any one or more of such duties, shall, on conviction before a Magistrate, be liable to a fine not exceeding Rs. 200, and shall be further liable, at the discretion of such Magistrate, to forfeit his license.

"Nothing in this section contained shall be construed to apply to the sale of drugs used by practitioners of indigenous medicines when such drugs are not sold in a shop or place where medicines are dispensed upon prescription" a criminal kind is not as a consequence frequent in the neighbourhood of Tavistock. The larger portion of the *arsenic* imported into India is used in trade, such as the cleansing and preparation of hides, paper, paint, wooden posts, etc., and occasionally also for agricultural purposes. The yellow variety of arsenic which contains from twenty to thirty per cent. of white arsenic is used as a pigment and largely as a depilatory.

Without presuming that the proposition is complete and free from defect or couched in the proper legal phraseology, the regulations of the sale of *arsenic* which we would propose take the following shape :—

That certain individuals or officials shall be entrusted by Government with the duty of granting licenses for the import, sale, purchase and possession of arsenic after having ascertained to their satisfaction that the applicants for such licenses are fit and proper persons to be granted the same.

That no arsenic or arsenical preparation recognized as a poison shall be bought or sold without a license except on the prescription of a licensed medical man with certain exceptions relating to the practice of indigenous medicine to be hereafter specified.

That persons desiring to import arsenic into the country must obtain a license authorizing its import, and must undertake to keep the arsenic in safe custody and to sell it only to persons producing a license authorizing them to purchase arsenic, all such sales being registered with an entry of the date, the quantity sold and the name and address of the purchaser.

That dealers in arsenic, whether wholesale or retail, must obtain a license authorizing them to buy, sell and possess arsenic, that they must undertake to buy from and sell to licensed persons only and to carry on their business generally under the same conditions as the importers, except in so far as its sale on medical prescription is concerned.

That persons requiring arsenic for manufacturing and other purposes not being those of sale, retail or otherwise, must obtain a license authorizing them to buy and possess arsenic for such purposes and must be prepared to satisfy the licensing authorities that they are fit and proper persons to be entrusted with the possession of arsenic, and that they are in a position to make suitable provisions for its safe custody both during use and at other times.

That in rural districts, and where necessary in towns, the practitioners of indigenous medicine if of good character may be licensed to buy and possess a limited quantity of arsenic only in each year and to dispense the same to their patients.

That pounded white arsenic, except in special cases hereafter to be determined, be sold mixed with soot or indigo in the proportion of one ounce to each pound of arsenic.

(B.) Amendment of those sections of the Bengal Municipal Act and Calcutta Municipal Consolidation Act which relate to the sale of drugs.

That the drugs named in the following lists to be known as Schedule A (European Poisons) and Schedule B (Indian Poisons) be considered as poisons for the Purposes of the Act :

SCHEDULE A.

European Poisons.

1. Arsenic and its preparations.
2. Mercury and its preparations.
3. Antimonial preparations,
4. Strong Ammonia,
5. Strong acids such as concentrated Nitric, Sulphuric, Hydrochloric and Oxalic.
6. Phosphorus.
7. Hydrocyanic Acid and Cyanides.
8. Opium, its alkaloids and preparations.
9. Belladonna, Datura, Hyoscyamus, their alkaloids and preparations.
10. Nux Vomica, its alkaloids and preparations
11. Aconite, its alkaloids and preparations.
12. Hydrate of Chloral.
13. Chloroform.
14. Carbolic Acid.
15. Cantharides and its preparations.

SCHEDULE B.

Indian poisons.

1. White Arsenic (Senko, Semulkhar).
2. Red Arsenic or Realger (Monchhal).
3. Yellow Arsenic or Orpiment (Harital)
4. Corrosive Sublimate (Raskarpura).
5. Aconite (Mitabish).
6. Datura.
7. Hyoscyamus (Khorassani Ajwan).
8. Nux Vomica bark or seed (Kuchila).
9. Plumbago rosea (Lalchitra).
10. Croton Seeds (Jaipàl).
11. Yellow Oleander (Kolika).
12. Cocculus Indicus (Kakmari)
13. Nerium Odorum (Karubi).

That in the same manner as suggested for the sale of arsenic, licenses be granted for the sale and possession of poisons.

That except under certain conditions and in certain quantities to be specified in each case, no poison within the meaning of the Act shall be bought or sold without a license except on the prescription of a licensed medical man.

That persons engaged in the merchandise of poisons as defined by the Act must obtain a license authorizing them to carry on such business, and must undertake to conform with the provisions of the Act and not to sell poison in any quantity larger than that permitted for its retail sale other than to duly licensed individuals, except on medical prescription.

That every sale of poisons except on medical prescription with certain exceptions relative to the practice of indigenous medicine must be duly registered in the following manner :—(a) Name of purchaser. (b) Residence of purchaser. (c) Object of purchase. (d) Authority for sale. (e) Quantity sold. (f) Date of sale. (g) Signature of the seller. (h) Signature of the purchaser.

That no person shall be permitted to buy and possess poisons who is unacquainted with their nature, and is not in a position to make proper arrangements for their safe custody and sale.

That in the shops of individuals licensed to sell poison, the poisons are to be properly labelled with the name of the poison and the printed word POISON both in English and Vernacular and kept apart from other articles of merchandise.

That in rural districts, and where necessary in towns, practitioners of indigenous medicine, if of good character, may be licensed to buy and possess and dispense to their patients limited quantities of the poisons included in Schedule B.

That all practitioners of medicine licensed to prescribe or dispense poison be registered.

That the same regulations should apply to persons requiring poisons for manufacturing and other purposes not being those of sale, as were recommended in the case of arsenic.

That it may be advisable to permit a limited retail sale of certain of the poisons included in the Schedules for domestic and other purposes, and that the drugs which may be sold, the quantities to be sold and the manner of the sale be hereafter determined.

That all patent and proprietary medicines, if found to contain poison within the meaning of the Act, come within the operation of its provisions.

(C.) Amendment of those clauses of the Board's Excise Opium Form No. 1 which relate to the retail sale of opium.

At the present time the largest quantity of opium that may be purchased from an opium vendor on one occasion by any single individual not being a licensed druggist or licensed vendor of opium, or of an intoxicating drug is five tolahs or two ounces.* This quantity is fixed by the Board's Excise Opium Form No. 1 as the extreme limit of retail sale. Two ounces of Indian opium are sufficient to poison from fifteen to twenty individuals, provided that they are not opium-eaters. Attention has already been drawn to the disastrous results of this system. The largeness of the quantity selected as the limit of the retail sale was, no doubt, due to the wish of the authorities to interfere as little as possible with the requirements of the opium-eater, and with use of opium as a domestic medicine. If the extreme limit of the retail sale of opium were fixed at one-eighth tolah or about twenty grains, no interference with its use as a domestic medicine would arise, as this quantity represents from twenty to forty ordinary medicinal doses. Twenty grains is, however, for an adult less than the minimum fatal dose of Indian opium, which is much less potent (five times less at least) than Turkey opium. Such a limit would also satisfy the requirements of a very large number of opium-eaters. The daily dose of opium eaten at the commencement of the habit is about half a grain, a quantity which, as is well known, undergoes gradual increase until a very much larger amount, even 100 grains daily, is ingested. But a very considerable proportion of pronounced opium-eaters never exceed fifteen to twenty grains per diem, and endeavour to subdue the craving for a larger quantity. The question now naturally arises as to how and where, if the retail limit be fixed at twenty grains, is the opium-eater, whose daily dose exceeds this quantity, to get his daily supply. The answer is a simple one. Either the opium-eater must be exposed to a trifling inconvenience in order to get the quantity he requires, or the danger to the general community at present existing must continue.

At the present time opium-eating is not to be regarded as a vice in any sense of the term, but only as a habit, the excessive gratification of which engenders very serious dangers to the community at large if it requires that large and fatal doses of opium must be sold without restriction.

It is not too much to require of the opium-eater, whose daily dose has exceeded the retail limit, that he should provide himself with a certificate to that effect signed by a medical man or a respectable individual, such as the headman of his village. We would suggest that such certificates should state the daily dose required, and should be valid for one year only, and that the opium vendor, on the presentation of a certificate of this kind, should be authorized to sell the quantity intimated therein, provided it does not exceed five tolahs.

The proposed amendment of the Board's Excise Opium Form No. 1 is accordingly as follows:—

That he do not except to a vendor of opium or of an intoxicating drug licensed by the Collector, or to a licensed druggist sell more than one-eighth tolah of opium to any person at one time except on the production of a certificate stating that the purchaser is an opium-eater, signed by a licensed practitioner of medicine or a respectable resident of the locality, when the quantity specified in the certificate, provided it does not exceed five tolahs in weight, may be sold.

All sales exceeding one-eighth tolah to be entered in a special printed record giving in addition to the information required in para. XIV of Form No. 1, the name and residence of the purchaser, the authority for the sale, and the quantity sold.

3.—Difficulties attending the introduction and working of such a measure.

Numerous objections suggest themselves, therefore it may be as well first to enumerate those which appear most important, and then subsequently deal with them in detail. The following are the objections which will be considered: (*a.*) That no practical decrease in poisoning will result by imposing restrictions on the sale of certain poisons while others being indigenous to the country must perforce remain easily accessible. (*b.*) That any change which may arise from the proposed measures will be distinctly a change for the worse on the ground that vegetable poisons will, after the enactment of such measures, be utilized to a greater extent than at present, and that such poisons are more difficult of detection than the mineral poisons now in use. (*c.*) That the proposed measures would necessitate an undesirable amount of interference with the domestic habits and customs of the people of the country. (*d.*) That they would interfere with the practice of indigenous medicine and thereby deprive the people in many districts even of the small amount of medical aid which they can obtain at the present time. (*e.*) That measures of the kind proposed would interfere with trade and many useful economic practices.

Without attempting to raise the question, whether the policy of temporizing with an admitted evil is correct, we would at once ask, what are the poisons which may be expected to take the place of *arsenic*, *aconite*, *opium* and other controllable poisons if these are rendered more or less inaccessible. If any such exist, they must naturally be sought among the indigenous drugs of the country, which belong for the most part to the vegetable kingdom. That the country has many vegetable products endowed with poisonous properties is easily learned by reference to the "Pharmacographia Indica" written by Dymock, Hooper and Warden. Fortunately, however, the knowledge of the poisonous properties of the majority of these substances is not yet by any means popular. They may, in consequence, be considered rather as potential than actual poisons at the present time, so far as the people generally are concerned.

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* That he do not, except to a vendor of opium or of an intoxicating drug licensed by the Collector or to a licensed druggist, sell more than five tolahs of opium to any person at one time.

As judged from general information, and from all the cases of poisoning which are reported, the number of indigenous vegetable poisons commonly known is very small. The following are the chief: *Opium*, *datura*, *aconite*, *nux vomica*, *oleander*, *abrus precatorius*. Opium heads the list, and is responsible for more fatal cases of poisoning than any other drug, but, as already shown, its accessibility can be controlled without imposing hardship on those who require it for a legitimate purpose. Successful interference with the possession of *datura* is apparently hopeless. Fortunately, the uncertainty of its action is tolerably well recognized. It is in consequence ill-suited to the murderer's purpose, as great risk of detection would be incurred should the poisoned man recover. The murderer does not of necessity desire to leave the locality of the murder; the robber, on the other hand, administers *datura* to assist him in the act of theft and to cover his flight with the booty. *Datura poisoning* is chiefly non-fatal. *Aconite* like *arsenic* is an imported poison, and though its introduction into the country cannot be so easily controlled as that of arsenic, yet, as the channels of introduction are well-known, a feasible plan to prevent the widespread dissemination of the drug should be practicable. The physiological symptoms set up by the chewing of even a small fragment of *aconite* root are a bar to its frequent use as a poison, and have frequently assisted in the discovery of the poisoner. *Nux vomica* trees can hardly be said to grow wild in this part of India in the same way as *datura*. They are to be found here and there, and have generally been planted for some purpose. Nux vomica seeds can, however, be readily purchased in the bazar. One seed is sufficient to poison an individual, and one tree may produce many hundreds of seeds. As nux vomica trees are not numerous, and do not grow wild, their cultivation, except in certain recognized places and by authorized individuals, should be prohibited. The cases of poisoning which arise from the use of *oleander* are, for the most part, accidental. The plant is to be found in most gardens, and like *datura* it is a poison which cannot be removed from the reach of the poisoner. Its poisonous properties do not seem to be very widely known, and its action is somewhat uncertain. The method of using *abrus precatorius* has already been referred to. The fact that it requires to be introduced subcutaneously is an efficient hindrance to its employment other than in a very limited number of cases of cattle poisoning. These then are the poisons which have been in use for half a century and more. The accessibility of three of them, *viz.*, *opium*, *aconite* and *nux vomica*, can effectually be controlled. *Abrus precatorius* is seldom used, and then only as a cattle poison. *Datura* and *oleander* remain, but their use (oleander, for homicide or suicide) is rare now, for the reasons already given, and for those reasons is not likely to become more prevalent. It is, of course, very difficult, if not almost impossible, to foretell what altered conditions may bring about; but as for many years there has been practically no apparent attempt among poisoners to strike out a new line, it may reasonably be hoped that the introduction of a restricted poison sale would, for several years, enforce a sensible diminution in this class of crime. It is of some interest to note that so long ago as 1843, Dr. Mouat, then Chemical Examiner, considered that the use of vegetable poisons was on the increase, and wrote as follows:—

> "The great majority of cases of the administration of poison had hitherto been arsenic. Lately, however, the exhibition of vegetable poisons has been more resorted to from its being known to *hakims* and native druggists that, while minute traces of any mineral poison can be unerringly detected, most vegetable substances defy analysis in the present state of chemical science. Some check ought to be put to the amount of murder committed in this way, unknown and unrecorded, by legislative enactment, punishing all vendors of drugs in whose possession those substances are found."

Dr. Mouat's apprehensions have, however, proved groundless, for Dr. Warden, referring to this statement, was able to state in 1886:—

> "The above was written about forty years ago; the fear expressed that *vegetable poisons* might supplant *arsenic* has not been verified. *Arsenic* is still the homicidal and cattle poison of India."

It will naturally be advanced that from Dr. Mouat's time up to the present, *arsenic* has remained easily accessible, and the necessity for discovering suitable vegetable poisons has not arisen. But even should the properties of indigenous vegetable poisons become generally known, these substances could never compete with *arsenic* in fitness for the poisoner's purpose. A comparison of the properties of *arsenic* and *vegetable poisons* as a class, will at once indicate the advantages which attend the use of *arsenic*.

Properties of *arsenic* and *vegetable poisons* generally:—

Arsenic.	*Vegetable Poisons.*
1. Tasteless.	1. Acrid, bitter or unpleasant taste.
2. Certain in action.	2. Uncertain in action due to the varying quantity of the active principles present in different specimens of the same plant.
3. The fatal dose is a small quantity.	3. To cause death, larger quantities are necessary of the majority of crude vegetable drugs.
4. Simulates in a remarkable manner the symptoms due to natural disease.	4. Do not simulate the symptoms of disease to anything like a corresponding extent.

The certainty of its action, its want of taste, the smallness of its fatal dose (two to three grains) require no further comment. They alone would give to *arsenic* a place in the front rank of the poisoner's equipment in any country. But the similarity of its symptoms with those induced by disease gives it in India a special value which is well illustrated by the following case: On October 28th, 1894, a man was admitted into the Mayo Hospital, Calcutta, suffering from symptoms of choleraic diarrhœa. He arrived alone and stated that he had come from Moorshedabad by steamer, having purchased and eaten food in the bazar before leaving. He became ill on board the steamer. After admission his symptoms were attributed by one of the medical officers to *arsenical poisoning*, but by three others, who also examined the patient from time to time, he was considered to be suffering from choleraic diarrhœa. The man died on the fourth day after admission, and a *post-mortem* examination was held. The condition found was one of general congestion of the alimentary canal with ulceration of the stomach and ecchymosis over the columnæ carneæ of the heart. Portions of the viscera were sent to the Chemical Examiner for analysis which revealed the presence of *arsenic*. It is legitimate to expect that many similar cases occurring in the district are returned without challenge as cases of cholera, if such a diversity of opinion can arise in a hospital provided with an experienced and expert medical staff. We have reason to believe, as already stated, that acquaintance with the vegetable poisons of the country and knowledge of their properties are not by any means widely diffused, even among the rural population. On the other hand it is, of course, quite impossible to determine what the practical knowledge of *hakims* and native druggists may be as regards indigenous vegetable poisons. In 1843, Dr. Mouat suggested that *hakims* and native druggists were beginning to put their knowledge to a criminal use. Whether this holds good at the present time, and to what extent, we are quite unable to say. In towns the practitioners of indigenous medicine are, as a class, a respectable body of men. No doubt here and there black sheep are to be found among the *hakims* who are not over scrupulous as to the methods in which they earn money. But should the scheme proposed be put in force, the *hakim* will be dependent for a supply of drugs very important if not essential to him in his practice upon the evidence of good character and conduct which he can adduce. In future the *hakims* would possess a definite status. A recognized position and the discharge of responsible duties are often sufficient to deter criminal instincts from the abetment or commission of crime.

Without implying that the detection of a vegetable poison is as certain as that of a mineral, it may yet be confidently stated that the chemical methods for detecting vegetable poisons have considerably improved since the time of Dr. Mouat's report already referred to. And though there is still room for further advance in this direction, much has been done, and vegetable poisons can be detected by chemical analysis of viscera with a very considerable degree of certainty, as compared with the results of fifty years ago. Should resort to indigenous vegetable poisons be stimulated by restrictive measures, it is probable that chemical research into the nature of these poisons, and the best methods of detecting them, would also be stimulated. Much has already been done in this direction by Dymock, Hooper and Warden.

If the proposed measures be carefully reviewed, it will be seen that special cognizance has been taken of customs and habits, and the measure so drafted that no undue interference with habits and customs can arise. In the measures to restrict the general sale of poisons, a special clause is introduced to legalize a small retail sale to unlicensed persons, the provisions of the clause to be hereafter determined.

The practitioner of indigenous medicine will not be interfered with in his practice, but will be recognized and registered; will, so far as the general community are concerned, become a more important, a more responsible, individual than heretofore. We are aware that the proposal to register the practitioners of the province has already been once made, and that it was abandoned on account of the difficulties of the task. We are now, however, approaching the matter from a different standpoint. It is utterly impossible to conceive of any scheme for restricting the sale of poisons, unless a register is kept of those persons to be entrusted with certain privileges with regard to poisons. A licensed or registered medical practitioner is the only individual in most countries who is allowed to prescribe, sell or possess poisons without challenge, and without having to keep a list of the quantity of poisons prescribed and sold by him in the discharge of his duties. The obligation to register his name and address is a very small matter indeed in return for such important privileges, nor need the Act of registration be made unduly vexatious. All medical practitioners in the employment of Government are already registered by the Imperial and Provincial Governments, and there would be no necessity to trouble them in any way. In Calcutta all practitioners of medicine have to obtain a license from the Municipality, permitting them to practise, and this would simplify the registration of medical practitioners in Calcutta very greatly. In small towns and rural districts, registration must of necessity be a very gradual process. It would follow on the exhaustion of the stock of poison in the possession of the practitioner of indigenous medicine and the necessity of obtaining a license before it could be replenished. A measure of this kind can only very gradually be brought into force among a population such as that of the province of Bengal. Numerous difficulties would, no doubt, be encountered in its introduction, and the full measure of benefit to be derived from its operation would only slowly be realized. But, on the other hand, without some such scheme of registration, the restriction of the sale of poisons seems impracticable.

Interference with trade will practically arise only from restricting the free sale of arsenic. The value of the average annual quantity of arsenic imported into the country at the Port of Calcutta during the last ten years has been about £308 sterling, valuing the arsenic at £14 per ton. The value of the average annual number of animals poisoned by arsenic in the province of Bengal only during the same period may be calculated as about £180 sterling. A certain amount of annoyance must of necessity be experienced in certain trades and occupations on the introduction of a restricted sale. It is possible that certain individuals who are now in the habit of using arsenic in their trade may be unable to obtain it in the future. Such objections should not, however, be allowed to carry any force. The convenience of the few can hardly have weight when the interests of a population have to be considered. Those persons who are fit to be trusted with poison will be able to obtain it under conditions of restricted sale as readily as at the present time. They will, moreover, have opportunities of realizing that they are responsible for the safe care of the poison which they are permitted to buy. The value of the arsenic imported into the country at the Port of Calcutta does not indicate that any important industry would be injured by the proposed measures.

We have now reviewed those objections to the introduction of measures restricting the free sale of poisons which appear to us to be the most important. For many years past the introduction of such measures has been frequently recommended. It is trusted that the sketch given in our paper of the present prevalence and nature of poisoning in the province of Bengal may serve to demonstrate that the necessity still exists. Without underrating the difficulties attending the introduction and working of such a measure incident to the special conditions prevailing in India, we are confident that its introduction would be attended by great reduction in crime.

We do not pretend that the measures proposed by us are free from defect or incapable of improvement. The scheme, such as it is, is submitted for criticism. In conclusion, we have to thank Dr. Simpson, Health Officer, Calcutta, Surgeon-Major J. B. Gibbons, Police Surgeon, Calcutta, Dr. Sasibhusan Ghose, Assistant to the Health Officer, Calcutta, Baboo Mohiny Mohan Chatterjee, Attorney-at-Law of the Calcutta High Court and Baboo Surendra Nath Mittra, B.A., Registrar, Bengal Secretariat, for information, and assistance in the preparation of the statistics contained in this paper.

DISCUSSION.

D. B. Roy (Calcutta) remarked that, although Drs. Evans and C. L. Bose gave a resumé of work done in their laboratory, he noticed that no case of poisoning by 'Abrus Precatorius' was mentioned in their paper; although it is known that this poison is used in other provinces for homicidal purposes.

Also the facts given regarding the causes which lead to poisoning and the selection of poisons by suicides and homicides, must facilitate medico-legal work in Bengal. He further remarked that, as the number of accidental poisonings was not small, some prevention was also necessary in that direction; and as their recommendation for an Act to restrict the sale of poisons had been made previously by medical jurists, the subject was of such importance that he hoped Government would take it into serious consideration.

E. W. Chambers (Coroner of Calcutta) remarked that he was glad to be able to supplement the admirable suggestions made by Drs. Evans and C. L. Bose, by placing in their hands copies of his official letters to Government, in September 1887, on the necessity for a Medical Registration Act; and in August 1891, for an Act to restrict the sale of poisons; and said that he had then drawn attention to the laws and regulations which regulate the sale of poisons in the United Kingdom and Bombay; further, that he did so as to show that these two important questions had not been previously neglected.

The President (Surgn.-Major Gibbons) said that he had lately read in the Viertel Jahrsschrift für Gerlichtliche Medicin a paper in which Dr. Fagerlund of the University of Helsingfors describes the results of regulating the sale of poisons as shown by the number of cases of fatal poisoning in Finland during 14 years from 1880—1893.

The sale of poisons has been strictly regulated in Finland for many years. The first ordinance is dated 1756, and this was followed in 1786 and 1797 by additional regulations. The regulations regarding poisons at present in force were published in February 1888, and the following account contains a description of the principal clauses. The ordinance divides poisons into two classes: the first includes poisons of a more dangerous character, the second those of a less dangerous nature.

Substances belonging to the first class may be imported by apothecaries and druggists, and by scientific institutions, trades and arts, provided that the necessity for them is certified by the Board of Trade. (Industrie Behörde). But the sale of substances of this class is confined to apothecaries and druggists.

Substances included in the second class may be imported and sold by any merchant who has received a license from the Governor. Manufacturers who have permission to make chemical preparations containing poison may sell them as articles of manufacture.

Poisons of the first or dangerous class must be kept by the vendor in properly secured vessels of glass or porcelain, or receptacles of wood or metal, labelled, clearly and durably, with the name of the substances; and the word "poison," in the Finnish and Swedish languages. Moreover the vessel containing the poison must be kept in a particularly safe place under lock, and the key must remain in the possession of the proprietor or manager of the establishment, or in that of a qualified assistant.

Dangerous poisons can only be sold on a written order containing the name, occupation and address of the buyer, besides the name and quantity of the substance required, and the purpose for which it is wanted. Moreover, if the buyer is not a druggist, he must give a written obligation to use the poison carefully, and not to make it over to any other person. He must also receipt the order before the poison is made over to him.

The vendor must dispense the poison in a properly secured vessel or receptacle, and, in addition to the label giving the name of the substance and the word "poison," in Finnish and Swedish, must affix a label with the seller's name, and decorated with three black crosses. In a factory where poisons of the dangerous class are made, they must be issued by the proprietor or manager, with the same precautions as to vessel and labelling as in the case of apothecaries and druggists.

A medicine containing a poison of the dangerous class must be kept by the purchaser in the same vessel or receptacle in which it was given out by the apothecary; and must be kept in a safe place, and in such a manner that mistakes cannot occur.

An apothecary may sell phosphorus for destroying vermin when mixed and coloured with other substances in such a way as to avoid the risk of a mistake; and other poisons similarly treated, to respectable persons who present a certificate from a magistrate or other official or a clergyman, to the effect that the applicant is a person to be trusted with the poison. But no substance containing arsenic may be used to destroy insects, to embalm bodies, or in fireworks; and hence apothecaries, druggists, and manufacturers are forbidden to sell arsenic preparations for any of these purposes.

Poisons of the less dangerous class must also be carefully stored, properly labelled, and given out with precautions mentioned in regard to the dangerous class.

Penalties are laid down for non-compliance with the regulations, fines, forfeiture of the substance, deprivation of license, etc.

The effect of these regulations may be judged by a consideration of the cases of poisoning, which occurred in Finland. Dr. Fagerlund gives a table, from which it appears that in the 14 years from 1880—93, only 471 cases of fatal poisoning occurred; and among them no less than 335 were due to alcohol, and 27 to carbon monoxide. The main facts will be seen in the following table :—

Name of Poison.	Nature of Cases.			Total.	Remarks.
	Murder.	Suicide.	Accident.		
Mineral Acids ..	4	10	4	18	Used in trades.
Carbolic Acid ..	..	2	5	7	Largely used as an antiseptic.
Lysol ..	..	1	..	1	An antiseptic.
Arsenic ..	4	4	1	9	In eight of the cases Schweinfurth's green, a dye stuff, was used. It appears to be employed by the peasants to kill vermin. One suicide with white arsenic.
Corrosive sublimate.	3	3	....	6	This substance appears to be smuggled into the country by pedlars and sold to peasants to kill vermin.
Alum ..	..	..	1	1	
Acid Chromate of Potassium.	..	5	1	6	Used in dyeing.
Mezereon ..	..	..	1	1	
Phosphorus ..	2	7	2	11	Sold mixed with grease, and coloured as a rat poison; the victims in the murder cases were children.
Cyanide of Potassium.	..	8	..	8	Used in photography and in galvanic batteries; the cases occurred among persons engaged in these trades.
Opium ..	1	2	2	5	In the murder case, the opium was obtained by a woman who personated a midwife, from an apothecary; the victim was a child.
Morphine ..	..	6	5	11	The accidental cases occurred through overdose prescribed by medical men.
Carbon Monoxide.	..	..	27	27	Most of the cases occurred through sleeping in rooms heated with stoves.
Alcohol ..	1	..	334	335	A man murdered a boy of 12 years, by forcing him to drink a quantity of brandy.
Wood spirit ..	..	..	1	1	
Chloral Hydrate	..	..	1	1	
Cocain ..	..	1	..	1	The source from which the poison was obtained was never discovered.
Aconitin ..	..	..	1	1	A man found a bottle in the road and drank some of the contents. It was discovered that a person lately come from America had brought a bottle of St. James' oil with him and lost it on the road.
Strychnine ..	9	10	2	21	Sold by apothecaries to kill vermin.
	24	59	388	471	
Total number of medico-legal *post-mortems.*	..	...	...	5,478	

NOTES ON THE CHEMISTRY OF THE SEEDS OF ABRUS PRECATORIUS AND "SUTARI" POISONING.

BY NORMAN S. RUDOLF, B. SC.,
Sarun.

CATTLE-POISONING in India is, I believe, much more common than it is usually supposed to be, as it is done in such a way as to avoid suspicion and almost to defy detection. In the district of Sarun, where I have had opportunity of observing the poisoners' methods, various poisons are used, but "sutari" or needle poisoning most attracted my attention.

Having heard much on the subject from the planters, I looked the matter up in the authorities and journals, and found that rather contradictory views seemed to be held as regards the nature of the poison, its mode of use and action. So, being on the spot, I have collected what information was obtainable, and made some investigations.

The following notes may prove not without interest to some. The poisoning is done mostly by *Chamars* and their *modus operandi* is as follows :—

The seeds of abrus precatorius or Indian liquorice are ground with gum and water to a stiff paste and fashioned into rods; these are dried in the sun or near a fire. They are then sharpened at one end by rubbing on a stone, fastened to a handle and are ready for use, the fine point being protected by a quill.

When an animal is to be poisoned, three or four of these needles are pushed under the skin and into the underlying cellular tissue, the spot most commonly chosen being the soft loose skin behind the ears.

The "sutaris" are generally inserted at night. Next morning the animal is languid and disinclined for work, limps, and holds down its head. The mouth becomes dry and food is refused, there is great thirst. The languor becomes more marked, the animal becoming more and more torpid, and finally dies of exhaustion some forty-eight hours after the insertion of the needles. Sometimes, however, the animal recovers, especially if it be carefully attended to and given stimulants. The length of time between the introduction of the poison and death varies considerably; it may be as short as ten hours and as long as three days, but two days (48 hours) seems to be about the average time which elapses.

The virulence of the poison appears to depend on the freshness of the seed from which the needles have been prepared, also on the length of time which has elapsed between preparation and use. If recently prepared they seem to be more poisonous. Sometimes other poisons are mixed with the seeds in the preparation of the needles, such as, madar, arsenic, mercuric chloride and *datura.* Snake poison is also said to be used, but as regards the truth of this statement I am unable to speak with certainty.

Abrus precatorius, from which plant the seeds are derived, is a common creeper, growing wild in many parts of India and elsewhere. There are three varieties of it giving seeds of different appearances. These are: red seeds with black spots, black seeds with white spots, and white seeds with black spots.

My investigations have been made on the red variety.

These are common in most bazars, being used as weights by the goldsmiths and native druggists.

A plaster of pounded seeds is used by the natives to reduce swellings, and from them an eyewash is also prepared. One or two finely pounded seeds are sometimes taken internally as medicine. The seeds taste very bitter. There appears to be a great deal of uncertainty as regards the effect of these seeds taken internally. The natives of Behar take them with great caution and consider them poisonous.

> Dr. William Murrell, in his small work on "Poisons," says: "They are said to be poisonous when swallowed, but this is probably a mistake, as they are eaten as an article of diet in Egypt."

In order to throw some light on this point, if possible, I made some few experiments on animals.

Experiment I.—Half a dram of crushed freshly gathered seed to a large dog. It was administered with his food. Violent vomiting was produced, but after the dog had got rid of the contents of the stomach he seemed none the worse.

Experiment II.—To the same dog, some few days later, I gave two drams of finely crushed, freshly gathered seed, mixed with a little food. Half an hour after administration, dog uneasy, trying to vomit, seems distressed, walking about; three hours after, is lying down, pulse quick, disinclined to move, refuses food, drinks water with avidity, seems in pain; six hours, has passed water in small quantity, refuses to move, appears to be in a stupor, much exhausted, pulse quick and weak; nine hours, much the same, but weaker, evidently dying. Ten hours fifteen minutes, he died quietly.

Experiment III.—Four ounces of powdered freshly gathered seed was boiled with a little water for thirty minutes. The whole was then made into cakes with flour and given to a large dog. It appeared to be perfectly inert and no bad symptoms developed.

Experiment IV.—Half an ounce of old and very dry seed was powdered and given to a large dog in food. One hour after, is uneasy, walking about; three hours after, lying down, languid and thirsty; six hours after, walking about, frothing a little at the mouth, but seems much better; eight hours after, ate some food, is practically all right again. A few hours later he was quite well.

From these experiments it is to be concluded that the seed is poisonous, but that the poison is destroyed by boiling, and that the virulence greatly depends on the freshness of the seed.

Chemistry of the seed.—Some experiments were made with the object of extracting, if possible, the active principle of the seed. The finely-powdered seed was extracted with alcohol, ether, chloroform, alkali, acid and water.

In each case one hundred grains of the finely-pounded seed were treated.

From these extracts it was attempted to prepare crystalline bodies, but without result. These extracts injected hypodermically into dogs produced no symptoms characteristic of poisoning by these seeds.

No alkaloid was obtained, and none appeared to be present.

Thinking it possible that a poison might be developed in the body after the introduction of the seeds, I prepared two extracts—an aqueous and an alcoholic—from the flesh surrounding the punctured needle wound in a poisoned dog.

These extracts produced no symptoms of illness in dogs or mice given internally or hypodermically.

At this point my researches stopped, as I had not the necessary leisure to continue them, but from the experiments done it seems evident:—

1*st*, that the seeds introduced in a powdered state hypodermically cause death;

2*nd*, that the seeds are poisonous if taken internally, but that the virulence of the poison depends on the freshness of the seed;

3*rd*, that by boiling with water the poison is destroyed or rendered inert;

4*th*, that the seeds contain no alkaloid or active chemical poison.

Many other interesting experiments could be tried which would throw more light on the subject, and as I propose to continue the work, I would be glad of any suggestions.

In conclusion I have pleasure in acknowledging the assistance kindly given me in collecting these notes by Assistant Surgeon Surrendra Nath Neogi of Sewan.

REMARK ON "ABRUS PRECATORIUS."

D. N. Roy (Calcutta) said that Dr. Rudolf had given, not only the results of his attempt to extract the active principle of the drug, but also some of the symptoms caused by it; and that our experience of recorded cases of cattle-poisoning agreed with his remarks on that head.

Abrus precatorius had been occasionally used for homicidal purposes, and the symptoms mistaken for those of snake-bite, the victim having been asleep at the time, and awakened by the prick of the needle.

But the differences between the two were known, both during life and after death. During life in "abrus" poisoning, there is a good deal of suppurative cellulitis around the injured part with constitutional disturbance.

After death, the signs of inflammation are prominent, and the remnant of the "sui" is seen; whereas, in snake-bite, no such foreign body is visible.

SALTS OF STRYCHNIA AS REMEDIES FOR SNAKE-BITE.

BY D. D. CUNNINGHAM, M.D.,
Surgeon-Lieut.-Colonel, I. M. S.

It would be a mere waste of time to enter upon any serious consideration of the evidence in favour of the various antidotes for the effects of snake-bite, which have been advocated on purely empirical grounds, were it not that at present there would seem to be a great tendency among many medical practitioners in this country to regard the salts of strychnia as practically efficient remedies.

That this should be the case is somewhat curious, seeing that there is really no more evidence of the efficiency of these drugs than there is of that of many old native remedies, such, for example, as that consisting of the dirt obtained from the *chillums* of *hukkas.* * The line of argument which has served to satisfy those who maintain that the salts of strychnia possess curative properties would appear to be of the following nature: A certain number of people, after having been bitten by snakes, have been treated with salts of strychnia and have not died, therefore salts of strychnia are antidotes to the action of the venom of snakes.

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* Clay Bowls of Pipes.

In many of the instances which are adduced in support of this conclusion there is not even any satisfactory evidence that the snake which inflicted the bite was a venomous one.

Dr. Leslie has been good enough to supply me with a copy of a note by him containing data regarding the majority of supposed cures of cases of snake-bite by salts of strychnia which have been recorded in this country. It includes a table from which it appears that, in seventy cases in which the treatment was applied, the nature of the snake which inflicted the bite is only supposed to have been accurately ascertained in fifteen instances, and this includes one in which a snake found on a road at Buldana is entered as *Enhyduna bengalensis*—an identification which can hardly fail to suggest the old lines regarding "flies" in amber.

Not only, however, is there this general incertitude in regard to the nature of the snake, but, even in cases where the species has been accurately identified as an unequivocally venomous one, there must always remain a residual and absolute uncertainty in regard to the amount and quality of the venom which was introduced into the system by the bite—it must always remain absolutely uncertain until demonstrated by results whether even a minimal lethal dose of venom is introduced by any individual bite.

It is clear then that the evidence in favour of any special method of treatment can possess no logical value whatever unless it include a very large number of cases of recovery after the bites of unequivocally deadly venomous snakes.

In the meantime no such series of cases is on record in respect to the treatment by the salts of strychnia, and yet, merely because a certain number of instances have occurred in which the salts of strychnia have been administered after the bites of snakes and death has not supervened, the advocates of the belief in the efficiency of the treatment apparently consider themselves to be justified in ignoring the evidence which is afforded by experimental data, and which clearly demonstrates that salts of strychnia are absolutely powerless to avert a fatal result even when the dose of a venom which has entered the system only amounts to a minimal lethal one.

But it is only by means of accurate experiment that the actual value of any alleged antidote can be fairly estimated, for it is only by experiment that the actual lethal properties of any particular venom can be determined, and it is only in experiments that there can be any certainty that a minimal lethal dose of it has been introduced into the system. Even the more cautious of the believers in the efficacy of the salts of strychnia appear to assume that the evidence in favour of the treatment in any case may be regarded as of practically conclusive value, if it can be clearly shown that the snake which inflicted the bite was a venomous one; that it was in a vigorous condition when it struck; that the bite was an efficient one; and that symptoms supervened. But this is, of course, very far from really being the case. The evidence is certainly of more value in such cases than where these data are wanting, but it is by no means conclusive.

A snake may be of a deadly venomous species, may be in full vigour, and may inflict a perfectly efficient bite, and yet the vemon at its disposal, when it strikes, may be deficient in quantity or defective in quality.

A venomous snake which has just ejected a large quantity of poison of the most lethal properties shows no signs of loss of vigour, and will strike and bite again efficiently very soon, but may at the same time be quite incapable of causing death. Even in cases where a venomous snake is in full vigour and bites efficiently so as to secure abundant ejection of venom of good quality, it does not necessarily follow that enough of this enters the system to give rise to a fatal result.

This is naturally specially likely to be the case where the bitten surface is protected by clothing, but it may also occur in the case of perfectly unprotected surfaces. A striking example of this once occurred within my own experience. One forenoon while I was busily engaged in attempting to secure a good negative of a newly-born rhinoceros, one of the best keepers whom we have in our local Zoological Garden came up carrying a large dead cobra in one hand and with a most efficiently bitten and ligatured finger on the other. He was not at all nervous, and gave a very clear account of how the accident occurred.

While passing along the outer side of the southern wall of the garden on his way home to his mid-day meal he observed a large cobra disappearing into a drain pipe which opened into a paddock in which we had repeatedly lost valuable ruminants from snake-bite.

He at once proceeded to extract the reptile, drawing it out of the pipe with one hand and slipping the other forwards along its back as he did so, under the expectation that it would resist extraction until his hand was so close to its head as to render it impossible for it to reach him, when he finally grasped it.

Unfortunately, however, it relaxed its hold of the pipe too soon, and, turning suddenly round, bit him on the finger. We took him at once to the entrance lodge of the garden, and there applied a second ligature to his arm, but the difficulty was to decide what to do next. Considering the nature of the instruments at our disposal, and the uses to which they had previously been put, there appeared to be some risk attending their employment, and, as at that time septicæmia had not come to be regarded as protective against other forms of poisoning, we naturally hesitated to make use of them. However, as a minor evil, we eventually did so, enlarging the punctures freely and getting a man to suck them. This he certainly did very efficiently, as he extracted pieces of fat and subcutaneous cellular tissue in the course of his efforts. We then made the patient immerse his finger in strong brown carbolic acid and drink about half a tumbler of brandy, and I then left him telling the superintendent of the garden that I should come back in the course of half an hour, and see whether our friend was dead. I did so and found him not dead, but dead drunk, and not unnaturally, complaining greatly of the pain caused by his finger. He never showed a symptom which would be fairly ascribed to the action of cobra-venom, and, although he did suffer from severe fever during the next few days, I am inclined to credit this to the treatment rather than to the primary injury.

Now in this case there was absolutely no doubt that the snake was a large healthy cobra, and that it inflicted an efficient bite, and there is every probability that it ejected venom freely. But the patient's own account of matters was probably correct. He affirmed that an abundance of venom was ejected, but that it ran down over the surface of his finger. The bite was situated on the second joint of the fore-finger, the poison fangs having entered the dorsal surface. But the depth of soft tissue is here so small that the channels of the fangs probably remained in greater part free, and the venom, as it was ejected, consequently ran off over the surface of the skin in place of penetrating the wound to any appreciable extent. Had the patient been of a nervous temperament, symptoms of psychical origin would, no doubt, have manifested themselves, but, as it was, no symptoms of any kind directly traceable to the injury occurred.

The case practically satisfies all the conditions which are regarded as demonstrating the efficiency of antidotes, but, in spite of this, I do not feel disposed to regard either carbolic acid or brandy as such. In regard to the value of the presence of symptoms in any case as affording evidence in favour of the efficiency of any alleged antidote, two things have to be taken into account: first, that nervous symptoms of purely psychical origin are very likely to manifest themselves in connection with cases of snake-bite, so that it is essential that the observer should be thoroughly familiar with the phenomena attending the action of the various kinds of venom ere his affirmation of the existence of symptoms can acquire any logical value; and, second, that symptoms, and even profoundly marked symptoms, may follow the introduction of doses of venom not amounting to minimal lethal ones. It is quite clear, then, that in any case it must remain absolutely uncertain whether death will ensue in any individual instance of snake-bite apart from the administration of remedies of any kind, and, therefore, that the occurrence of recovery after the administration of salts of strychnia is no satisfactory proof that the latter possess any remedial properties. Are we seriously to prefer evidence of this kind to that which is afforded by experimental data from which all sources of uncertainty are excluded? In the paper containing the table previously alluded to, Dr. Leslie suggests that the evidence at all events appears to indicate an abnormal tolerance of strychnia in cases of snake-bite, and there are certain experimental data which seem to point in the same direction. This, however, cannot be taken as satisfactory evidence of the presence of any truly reciprocal physiological antagonism between the two poisons. The experimental data certainly suggest that cobra-venom may be partially repressive of the action of salts of strychnia, but they also clearly show that the latter are powerless to affect that of the venom.

There is one somewhat quaint point in regard to the belief in the efficiency of the salts of strychnia as antidotes for snake-venom. Its adherents seemingly regard these salts as constituting a universal panacea against the action of all kinds of venom. But this implies a belief that in some cases they act homœopathically, and in others allopathically, for in cases of acute viperine poisoning the symptoms in many cases are those of extreme irritation of the nervous centres, whereas in cases of cobra poisoning they are indicative of nervous depression. The symptoms of acute viperine poisoning in many cases are practically identical with those of acute strychnia-poisoning, and yet it is seriously proposed to endeavour to induce the latter in order to cure the former!

THE SYMPTOMS AND TREATMENT OF SNAKE BITE IN INDIA WITH SPECIAL MENTION OF DR. A. MUELLER'S SUBCUTANEOUS INJECTION OF STRYCHNINE, BASED ON THE CONSIDERATION OF 37 CASES.

BY J. DUKE,
Surgeon.-Lieut. Colonel, I. M. S.

I HAVE ventured to bring as my subject "the symptoms and treatment of snake bite, with special mention of Dr. Mueller's subcutaneous injection of strychnine" before this Medical Congress, gathered from all parts of India, for three reasons: (1) Because it is a matter of more than special interest and importance to Indian doctors; (2) because the use of strychnine hypodermically is a new remedy now on its probation, and the subject of some controversy; (3) with a view of raising a discussion and gauging the public opinion of this meeting as to its value.

The hypodermic injection of strychnine in man for snake bite is comparatively new; for its introduction we are indebted to Dr. Augustus Mueller of Victoria, Australia, who claims originality in its use; and who, moreover, puts it forward as an infallible cure for all the snake poisons of Australia.

The marked success attending its use in that country carries hope and conviction of a forcible character; regarding India his remedy is now on its trial. The Government of this country in answer to his appeal are carefully collecting data on this subject. But they have, and I think most wisely, deferred passing a definite opinion on so vital a matter, until the end of the year 1895, a period of three years' probation. In such a case, an impartial view is called for a cool and unbiassed judgment Before proceeding to the facts I must place before you, I propose to review very briefly Dr. Mueller's views on this matter ; the claims and pretensions put forth for his remedy. In 1890 Dr. Mueller petitioned Her Majesty the Queen, urging the introduction of his remedy for the poison of Indian snakes. Sir Joseph Fayrer, K.C.S.I., as medical head of the Indian Board, London, advised that an antidote supported by the positive assertions of a man of science like Dr. Mueller ought to be tried ; though, he added, that his own experience did not warrant an expectation that the antidote would be successful in the case of the Najida (cobras). In his petition to Her Majesty Dr. Mueller states that in strychnia, administered in large doses by hypodermic injection, he has discovered an infallible remedy for snake bite, one now universally adopted in Australia. In his letter to the Government of India, Calcutta, dated Victoria, 22nd December 1892, he suggests that—

1. Experiment on the lower animals be dispensed with as misleading.
2. That in man, with symptoms of snake poison, strychnine should be injected, regardless of the total quantity required to subdue these symptoms, and that should they appear again after an interval, the antidote be again resorted to.
3. That doses of never less than one-tenth of a grain be used, increased in urgent cases to one-sixth or over one-fourth, and repeated every 15 or 20 minutes, until the symptoms of snake poison are removed.
4. That in certain cases where one or both fangs have perforated a vein, the intravenous injection be substituted for the hypodermic, the antidote thus poured into the blood stream in large doses being capable of turning the scale of life in favor of persons already pulseless at the wrist and having ceased to breathe.
5. That strychnine as an antidote to snake poison is not cumulative.
6. That snake poison, if only partially subdued by insufficient use of strychnia, overpowers the motor nerve centres, often very insidiously, as soon as the effects of strychnia have worn off ; and that, therefore, the danger lies not in the *too free*, but in the *too sparing* use of strychnia. Whenever the drug is freely injected, both the viperine and colubrine poison must necessarily yield to it in all ordinary cases of snake bite in India.

In his latest communication,* August 1894, Dr. Mueller recommends in bad cases an injection of 16 minims of liquor strychnia B. P. to be repeated in 15 minutes if the patient does not improve, and a continuation of 8 minims every 15 minutes until all symptoms have disappeared, or until the physiological effects of strychnine begin to develope. In the worst cases one-third to one-fifth of a grain has been necessary. Dr. Mueller affirms—

1. That strychnia acts regularly and promptly.
2. Its action stops after a time entirely.
3. The snake poison developes regularly.
4. The snake poison sometimes remains latent in the system for a considerable time, so that when it has been apparently conquered for a time, it may suddenly start a new course of symptoms.
5. That injections of strychnia should not be employed until unmistakeable symptoms of snake poison are perceptible.
6. For the snake poison may act so slowly that the patient succumbs before the state which requires and neutralizes its actions has developed.
7. The patient must be watched for 24 hours after the disappearance of the last symptoms in order to be able to combat in time a sudden relapse.

Dr. Mueller's well known views have now been clearly put forward. The infallibility of his antidote in the case of Australian snakes we may accept as the language of an enthusiast in a good cause. But that the viperine and colubrine poison of Indian snakes must necessarily yield to it can only be proved by actual practice. Evidence in favor of and against the antidote I hope shortly to place before you. Before proceeding further I propose very briefly to place before you Dr. Fayrer's opinions on the subject of snake bite and its treatment. Hitherto Sir Joseph Fayrer has been the recognized authority on the poisonous snakes of India. His book, the Thanatophidia of India, magnificently illustrated, is the standard work in all libraries. Space compels me to curtail his views into the smallest possible space. In 1872 his views are as follows :—

"Snake poison is essentially a neurotic, and when it takes full effect it kills by annihilating in some unknown way the supply of nerve force."

On the effect of poison he says :—

"In the Viperidæ the coagulability of the blood after death is destroyed. In the Colubrinæ the blood after death generally coagulates."

On the subject of antidotes, his opinion is decided as follows :—

"My own impression is, that in case of a real bite by which I mean when a healthy cobra or daboia has imbedded its fangs and innoculated the poison there is very little chance, if any, of saving life unless the most immediate and vigorous aid be given ; and then, even at the best, there is but poor chance of safety. The real bite when the fatal hypodermic injection of the poison takes place is when the snake seizes, retains its hold and thoroughly imbeds its fangs in the part, I have shown by experiment that, if the bitten

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*Extract from *Therapeutic Gazette*, August 1894, page 383, *Indian Medical Journal*, 1894.

Part can be instantaneously and completely separated from the rest of the body by ligature or excision poisoning may be averted from entering the circulation, whilst every other method tried, whether local or constitutional, has entirely failed to do any good.

"If the poison finds entry into the blood vessels and be carried to the nerve centres I am inclined to believe that nothing can prove of any avail, except in those cases where the bite is imperfect, the quality and quantity of the poison diminished or detoriorated, or the snake itself young, weak or exhausted.

"But I must again state my conviction that, nothing that can properly be called an antidote to cobra or viper poison, exists" (At page 74 and 75 of his work the Thanatophidia, 1872).

Three experiments on strychnine as an antidote are given :—

"No. 1. 12 37 dog bitten by large fresh black cobra.
12 38 strychnine gr. $\frac{1}{3}$ injected.
12 39 tetanic spasms.
12 43 death in 6 minutes."

Dr. Fayrer candidly remarks :—

"In this case death was entirely due to tetanus. There was neither time nor opportunity for any manifestation of the effects of snake poison."

No. 2. 12 45 dog bitten by powerful fresh black cobra.
12 46 strychnine gr. $\frac{1}{4}$ injected.
12 51 death in 6 minutes from tetanus.

No. 3. 1 20 cat bitten by a Daboia Russelli.
1 23 strychnine grain $\frac{1}{6}$ injected.
1 27 death in 7 minutes."

Sir J. Fayrer remarks in this case : "Strychnia seemed rather to accelerate death than to improve the animal's condition and the cat died in a state of tetanus."

These few cases are dismissed with the remark that "strychnia was suggested as an antidote to snake poison these experiments do not support this theory." Time alone prevents my quoting Fayrer more fully.

We have now placed, side by side as it were, the views of two specialists on the treatment of snake bite. According to one (Fayrer) no antidote exists for snake bite, according to the other (Mueller) in strychnia we have an infallible antidote. The decision of Fayrer in regard to strychnia is apparently based on three experiments on animals in which curiously it is allowed that the three animals subjected to the test died from the remedy itself and not from the poison. Therefore strychnia was noted as useless as an antidote. Doubtless many patients who recover from snake bite include Fayrer's exceptions "when the bite is imperfect, the snake young, weak, or the poison admitted in small quantity. Still there is little doubt that many patients do succumb to even imperfect bites.

I now hope to prove by actual cases : (1) That many patients (ordinary cases) have been saved from impending death by the subcutaneous injection of strychnia. (2) That cases "really bitten" (Fayrer), the snake seizing, burying its fangs and holding on have also recovered by the hypodermic injection of strychnia.

The cases reported are divided into three tables, as follows :—

X.—Dr. R. P. Banerjee's cases	...	...	8
Including for convenience, Victoria Hospital, Rewah, Central India	...	...	1
Y. —Indian Medical Gazette cases	...	...	11
Z. —Bhopawar Agency Central India		...	17
	Total	...	73

The recoveries and deaths are as follows :—

			Recovery.	Death.	Total.
A.	Case ...	... 8	9	9	9.
	Do. ...	... 1			
B.	Cases ...	... 11	8	3	11
C	Cases ...	... 17	8	9	17
		37	25	12	73

Percentage.—Recoveries ... ... 67·5
Deaths ... ... 32·4

Of these 37 cases *X.*—All Dr. Banerjee's cases have been published (*Lancet* 2 *Indian Medical Record*). *Y.*—All have been published in the *Indian Medical Gazette*. *Z.*—The 17 cases, Bhopawar Agency and 1 Rewah (in all 18), have not yet been published.

Time does not permit of my reading the set tables. They are attached to this paper, and special cases will be referred to by numbers.

Precedence must by courtesy be given to Dr. R. P. Banerjee's (Medical Officer, Pachbadra Salt Mines, Rajputana, India) cases. This gentleman may, I think, be considered the pioneer who has led the van of the strychnia treatment in India.

His report of eight cases, all recoveries, carries with it conviction of the most practical kind. The remedy was administered in the bold and fearless manner, according to the fullest wishes of Dr. Mueller. The amount of strychnia used by Banerjee is enormous amounting to (Case 4.) 3 grains spread over four days (case 7) to 4 grains.

Yet his success was complete, we must therefore accept its genuineness.

His cases prove the large amount of strychnia necessary to cope with a large amount of snake poison and the safety of strychnia under such conditions. In some of his eight cases the variety of snake is not clearly defined.

This fact, appears to me to be of little material importance ; for, had not snake poison been present, in marked or perhaps fatal quantity, the patient must have died from the effects of strychnia as the three animals did in Fayrer's experiment.

I lay particular stress on this because strychnia as an antidote is on its trial, and I believe that time will give a verdict in its favor. But if this remedy has its supporters it also has its opponents. In the September issue of the *Indian Medical Gazette*, Dr. Elliot, Professor of Biology, Madras, concludes his letter on this subject as follows : "I feel it a duty to state that I consider the free administration of strychnia in snake bite to be far from a safe proceeding. This opinion is shared by many leading officers of the Indian Medical Service of Madras who have witnessed my experiments on it." *Quot homines tot sententiæ.*

If the large quantities of strychnia used by Dr. Banerjee with perfect success have been correctly stated by him, then, I think, the practical test in man (*in corpore vili*) must sweep away as unreliable experiments on animals. (But Dr. Elliot's interesting experiments when published will be looked forward with interest.) Speaking generally, one would like to ask Dr. Banerjee whether the cases reported by him represent all snake bite cases treated by him, or whether only successful results have been reported. As it stands, Dr. Banerjee holds the record for India. Regarding the fatal dose of strychina, I believe ⅙th of a grain is the smallest lethal dose allowed.

Morell, in his, book on poisons, says three grains are usually fatal. Smaller doses are sometimes fatal, grain half for example ; grain one-sixteenth may kill a child. The ordinary dose of strychnia is from one-thirty to one-twelvth grain. Hypodermic administration intensifies the effect of a drug as 3 to 1. I was taught that one grain of morphia administered hypodermically was equivalent to three grains by the mouth. In Dr. Banerjee's case (No. 8) a relapse occurred after 48 hours' interval, but one-tenth grain brought the patient round. Dr. Mueller has pointed out the danger of a relapse.

*Table Y.**—Comprises all cases treated by European medical officers and published in the *Indian Medical Gazette*, October and November 1894. Of eleven cases reported three died, giving a mortality of 27·2 per cent. and recoveries 72·7 per cent. Add to these 11, the nine cases previously quoted, and we have 20 cases with three deaths, giving a mortality of only 15 per cent., and thus placing the death-rate from snake bite on an equality with ordinary disease.

In this table the bite is reported to have been inflicted by the—

A —Cobra	in	3 cases.
B.—Krait	in	2 cases.
C.—Daboia R.	in	1 case.
D.—Unknown or believed to be a certain variety		5 cases.
Total	...	11

Of the three fatal cases, two include the great unknown. Such will, and I believe must always be, the case. In India, the majority of Hindoos will not kill a snake considering it a sacred reptile. In this we differ from Australia where all such reptiles are killed when seen. In India the snake is rarely brought with its victim. Numbers of cases are bitten in the dark and at night people sleeping on the floor. The unknown includes probably the most deadly. It is a habit, and a bad one, where the snake has not been killed or properly viewed, to class recoveries under strychnia : as the result of the bite of a harmless snake recoveries, where only gr. one-tenth or one-twelvth have been used, give some color to this view. In table Z the unknown, generally unseen, caused appalling mortality.

Table B.—In the majority of recoveries three-fifths of a grain of strychnia was used.

Recoveries in case (4—Dr. Drake Brockman.) The snake, a cobra, bit well, and was thrown off by the man attacked. A ligature was applied ; 20 minutes after symptoms very severe, pupils dilated, foaming at mouth. Patient practically moribund when strychnia was used. One-sixth grain was used in one-twenty-fourth grain doses at intervals.

Recovery in this case may be absolutely attributed to the use of strychnia. The ligature (a most important detail) probably prevented this poison killing the man right off. The dose gr. one-sixth used is very small.

But the case was one of Fayrer's "real bites" in which he states that nothing can prove of any avail. "The man had to tear the reptile off by pulling at it before it would release its hold." In case (2—Surgeon Captain Vaughan) the snake seized and held on to the ulnar edge of hand, and had to be torn off. It was believed to be a krait. Strychnia three-fifth grain was used.

Case (9—Dr. Prall.) The patient brought in the snake that had bitten him, a small living cobra, strychnine three-fifth grain, patient profusely salivated. Salivation would appear to be almost diagnostic of cobra bite judging from cases noted.

Fatal cases No. (6) Unknown. It is not stated whether a ligature was applied. Strychnine used 3 hours after bite, one-seventh grain. An interval of eight hours followed when again one-seventh was used; then another interval of two hours when three successive doses of one-seventh were administered at 20 minutes interval. In all one grain and ⅐th grain are said to have been used. This is not altogether a satisfactory case owing to the unequal method of administration.

Case No. (8) Bite was on body ; half grain used.

Case No. (11) Genuine cobra ; report does not state whether ligature was applied. Treated 3½ hours after bite; symptoms marked, foaming at mouth, dilated pupils.

Treatment commenced 4-30 P.M. 5-16 P. M. death, 46 minutes after commencement of treatment. In the time 135 minims or grs. one and one-third had been given hypodermically. In this case the poison had three and half hours in which to assist itself. One is, I fear, inclined to suspect the strychnia which was pushed in a heroic manner.

Recovery. The Victoria Hospital Rewah case is attributed to a cobra, pupils dilated, unconscious, bite marks on great toe, strychnia one-fifth was administered every 20 minutes; four doses, in all four-fifths of a grain recovery followed, which must be attributed to remedy.

The Bhopawar Agency list must next be faced. Of the 17 cases reported I have personally seen and treated none. All my dispensaries, 14 in number, are provided with carefully printed instructions for the strychnia treatment of snake bite according to the attached circular. The details have been sent in to my office.

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* *Indian Medical Gazette*, October 1894.

Instructions to be followed in the treatment of

1. Snake Bite.

1. Apply a ligature around limb above bite, and scarify freely.
2. Inject subcutaneously. For an *adult* liquor strychnia Pharmacopœia British, Minim X=1/10 grain subcutaneously, every ten minutes, according to the severity of the symptoms,
3. The snake poison is not as a rule overcome, until muscular twitchings are set up by the strychnine.
4. 2/5 grain or Minim XL of the solution is usually required; administered in four injections, to overcome the symptoms. But as much as from grain i to grain iii have been used, and, with success.
5. If a relapse occurs the treatment must be continued.
6. The large subcutaneous doses often required to overcome the snake poison are said to produce no after bad effects.

Strength of Solution is nearly as follows :—

M i = 1/100 grain.
M v = 1/20 do.
M x = 1/10 do.
M xv = 1/7 do.
M xx = 1/5 do.

2. Scorpion Sting.

Inject subcutaneously close to bite cocaine solution.

Strength :—

Cocaine grain v.
Water, minim 100.

Immediate and permanent relief follows.

Dose:—Adults, m i. to m v.
Infants & Children m i. to m v.

3. Mad Animals' Bite.

1. Under chloroform open up wound, and stuff with crystals of potassium permanganate.
2. Then inject subcutaneously deeply into the tissues below each bite, in two places m v. of pot. permanganate solution.

Strength of Solution :—

Potassium permanganate gr. v.
Aqua m. 100.

3. Each tooth bite must be treated carefully and separately.
4. Much swelling often follows the treatment.
5. Permanganate of potassium readily gives off oxygen, and thus oxides organic matter. My opinion is that its action destroys, locally, the poison of hydrophobia.
6. Chloroform is not necessary, but its use is advised as the subcutaneous injection causes much pain.
7. Upwards of ten cases of people bitten by animals, presumably, and with good reason, believed to be mad, have been thus treated at Sirdarpore, in the Victoria Hospital, and, so far as can be ascertained, none have succumbed to hydrophobia.

The information now offered is, in many cases, reliable. In some it is open to doubt; the details of two, Nos. 9 and 10 having been most imperfectly supplied, In some, I fear, the remedy has not been vigorously used. The hospital assistant fearing that cases seen only when moribund death may be attributed to the remedy, not the snake poison.

Table Z.—Of the 17 cases, eight recovered and nine died, giving a mortality of 52. per cent. But if four doubtful cases, Nos. 1, 2, 3, 14, be eliminated, we have 13 poisonous bites with four recoveries and nine deaths, a mortality of near 70 per cent. If four cases admitted moribund are deducted from the nine fatal, then the mortality is reduced to 55·5 per cent.

In only two of my cases reported was the snake killed. In eight it was not even seen. In seven the reptile was seen and described generally.

Recoveries— Table Z.—In cases 1, 2, 3. It is doubtful whether the snake was poisonous. The dose of strychnia used was respectively grain one-tenth, one-twentith, one-tenth. Case 4, 5, 6 are recoveries, due I consider to strychnia. In case (4) one fifth grain was used ; in case (5) two-fifth grain was used ; in case (6) two-fifth grain was used.

Case 6 was a "real bite" (Fayrer). I call it a fixation bite. The snake seized the man, returning from a call of nature in broad daylight, by the ankle, and hung on like a dog, only loosening its hold when kicked by the other foot. It then made at the man again, who fled (see case 4, Table Y.). The snake was a cobra. Symptoms severe, frequent convulsions, strychnine one-tenth was injected in four doses at intervals of 15 minutes or so. *Case* (13) convulsed 15 minutes after bite ; physiological effects of strychnia set in after 3rd three-tenth grain and continued for two hours. Quantity used three-tenth grain. Case 14.—Said to be a grass green snake ; no serious symptoms ; only grain one-tenth used.

Fatal Cases.—These are important and instructive. No. 8. Female, aged 40, bitten in finger by a cobra, circumstantial evidence, patient brought to hospital, finger bleeding and complained only of drowsiness and pain in the head. Strychnia grain one-tenth injected ; symptoms of unconsciousness in 15 minutes, grain one-tenth again used. In 20 minutes patient deeply insensible, one-twentieth only of a grain used, death in 45 minutes. In this case no ligature was used. The cobra was known to be large one ; only quarter grain was used. It was the hospital assistant's first case His second case No. 6 recovered. No. 7.—Patient moribund on admission, having been treated by quacks for four hours. Strychnine, grain quarter, said to have been used. Died an hour after admission. Nos. 9 and 10 are men bitten by presumably the same snake. They were sleeping on the ground 20 feet apart. No. 9 in ear ; admitted 2 A.M., died 3 A.M. No. 10 in leg ; admitted 6 A.M., died 8 A.M. Both were said to be moribund when admitted. The report simply states that the strychnia treatment was used.

Case 11. Child, aged five, bitten by a black snake three and half feet long ; seen half an hour after. Then moribund. Insensible, foaming at mouth (cobra). No ligature had been applied. Liquor strychnia m. x. injected twice but patient died immediately. Cases 9 and 10 should be excluded as test cases I consider. These five fatal cases appear to come under Dr. Mueller's saving clause where intravenous injection is required. Hitherto, no report has yet appeared of cases in which this method has been used. It is therefore desirable that medical officers and others should try this method in cases where respiration has failed and the patient is pulseless.

Case 12—Is fully detailed. Sepoy bitten on inner ankle at an outpost when going to sound the gong at 5 A.M. Nothing was done for three hours. Then a ligature was tightly applied, and wound incised freely. Patient by this time in a bad state, pupils dilated, body livid. No mention made of salivation. Snake killed, a krait. Strychnine then continuously used by one-tenth grain injections at intervals, on eleven occasions, without the slightest benefit. In all hypodermically one grain one-fifth. (The hospital assistant in his report says that three grains were used, hypodermically, without benefit.)

Patient bitten 5 A.M., treated 8 A.M., died in 31 hours. Here the snake poison had full play for three hours, and then, though vigorously attacked, was not overcome. The remedy here was not pushed rapidly (as might have been the case in Table Y, No. 10). No notices made of tetanic spasm.

Here I think failure must be recorded. *Cases 15, 16, 17* (Table Z.) are attributed to the bite of the Daboia Russelli. They are of quite recent occurrence, *viz.*, August and October.

Case 15.—The notes are mislaid; they were taken at the village after careful enquiry; patient was bitten in hand. She was treated by three injections. She was never insensible. Her chief symptoms were acute, agonising local pain and swelling of limb.

On the third day, she had a miscarriage, (3 Nos.) and died a few hours after.

Case 16—Adult male bitten in the same village by same snake a Daboia, over ankle, at 4 P.M. October 1st; seen soon after. Between 4 P.M. and 11 P.M., three-fifth were injected at long intervals.

Oct. 2nd.—6 A.M. Patient quite sensible but swelling up to hip with excessive pain (cocaine grain ½ injected, gave no relief at 6 P.M.) *Oct. 2nd.*—8 A.M. Suddenly became insensible; one-seventh grain was then injected into each arm, but the patient died at the time. Death 16 hours after bite. Quantity used seven-sixteenth grain strychnia.

Case 17.—Female, pregnant eight months, bitten in ankle by a Daboia at out village. An assistant was sent out, and remained with patient three days. He injected strychnia. Details not given. Local swelling and pain chief symptoms on the seventh day after bite, labour set in, and the woman died some hours after.

Case 15, 16.—Were, it is stated, both bitten by the same snake, a large Daboia Russelli. The snake had been seen several times at a place where the people resorted for the purposes of nature. Soon after a small Daboia was killed on this spot. The people, however, declared that it was a big Daboia that killed case No. 15, 16.

In Central India, the Daboia Russelli and the Diwar are the same. I say this after most careful enquiry. I cannot find the word Diwar mentioned in Fayrer's book. But, locally, the natives affirm that the specimens and skins of the Daboia shown to them are one and the same as the Diwar. When the bite of the Diwar does not cause death it frequently causes local death of the limb bitten, after most acute suffering, such as corresponds with gangrene. In support of this statement that local death follows its bite, I quote the following cases: In Jan. 1887 I amputated a leg, at the upper third, for gangrene, the result of the bite of a Diwar. In Jan. 1888, in the Victoria Hospital, Sirdarpore, I amputated a leg, upper third, for gangrene following the bite of the Diwar. In March 22nd, 1888, I again amputated a woman's leg, middle third, for gangrene due to a Diwar bite. The gangrene in these cases was not, I believe, due to ligature of the limb. As the following note in my operation book shows:—

NOTE.—"*In October 1887.*—Woman, bitten by a snake "called a Diwar, on instep near big toe. Severe "swelling immediately set in. No ligature was applied. "After suffering great agony, mortification set in "commencing at the bitten part."

I had, then, never seen a Daboia, no specimens having been brought in, but I have procured many specimens since.

Curiously, in a book on snakes, mention is made of the case of a syce bitten on the forearm by a Daboia, whose limb was removed at the shoulder for gangrene, attributed to a ligature. Judging from the cases quoted above it seems possible that the gangrene was caused by the local poison.

Cases 15, 16, 17—Were reported by the same hospital assistant.

Conclusions are as follows: *General*—(*a.*) The poison of the cobra is the most deadly of all Indian snakes. (*b.*) That foaming at the mouth is one of the diagnostic signs. (*c.*) The poison of the Daboia Russelli though less deadly, causes also local death of the part, this differing from other snake poisons. *General treatment*—(1.) Local ligature of the digit, finger, or limb, above the seat of bite, so as to completely stop the circulation, is imperative and urgent. (2.) That one or more ligatures should be placed above the first construction. (3.) Local depletion and bleeding should be adopted, the incisions being free and very deep. (4.) Or if the bite be on the body, the seat of the bite should be freely excised. *Constitutional treatment*—(*e*). That based on the experience gained by Dr. Mueller's method (now a considerable number of cases) *viz.*, the hypodermic injection of strychnine, is the best, in fact the only remedy to be relied on. (*f.*) That its use be carried out with the boldness recommended by him, but, at the same time, with careful watchfulness, and only after the symptoms of snake-poison have pronounced themselves. (*g.*) For we are dealing with a poison that may itself cause death if not counteracted by a proper ratio of snake venom in the blood. (*h.*) That, in cases moribund when seen, *i.e.*, pulseless and respiration having ceased, the intravenous injection be adopted. (*i.*) That though experience proves much in its favor, strychnia, cannot, at this stage, be considered a certain cure, for the poison of all the colubrine and viperine snakes that inhabit the Indian Peninsula.

The question of the value of strychnia in cases of snake bite inflicted on man by a vigorous cobra or krait could, I venture to think, be settled definitely and satisfactorily if Government would permit its trial on the persons of criminals sentenced to death, say, 6 individuals. The bite should be inflicted fairly by vigorous animals and no treatment adopted for 30 minutes.

If death follows the criminal receives his due. If recovery follows, sentence of death might be commuted to life servitude.

Dr. Mueller asserts that his remedy is an infallible cure. He might be requested to visit India and carry out his own treatment on these cases.

Table X.—*No. 1 to 7 published in "Lancet," May 28th, 1892 —Dr. Banerjee's cases of Snake bite, Rajputana.—Case 8 in "Indian Medical Record," 1893.*

No.	Date.	Age.	Sex.	Snake.	Place of bite.	Strychnia amount.	Result.	REMARKS.
1	1891	30	M.	Echis C. ...	Left foot ...	1½ grains ..	Recovery.	
2	1891	12	M.	Do. ...	Inner ankle ...	¼ " ...	Do.	
3	1891	35	M.	Do ...	Outer ankle ...	1¾ " ...	Do.	
4	1891	40	F.	Krait ...	Left thigh ...	3 " ..	Do. ...	3 grain spread over 4 days.
5	1891	67	F.	Not stated ...	Left foot, big toe ...	½ " ...	Do.	
6	1891	35	M.	Echis C. ...	Left leg, below knee	Not given ...	Do.	
7	1892	45	M.	Not given ...	Not given ...	4 grains ...	Do.	
8	1892	45	M.	Daboia ...	Instep ...	$\frac{4}{5}$ " ...	Do.	
				VICTORIA HOSPITAL, REWAH, CENTRAL INDIA.				
9	1893	Adult.	M.	Stated to be a Cobra.	Left great toe ...	¼ grain ...	Recovery.	

Table Y.—*Cases of Snake bite published in "Indian Medical Journal," January 1890 to November 1894.*

No.	Date.	Reporter.	Age.	Sex.	Snake.	Seat of bite.	Interval before treatment		Strychnia used.	Result.
							H.	M.		
1	1892. October	Surg.-Major Cadge ... Surg.-Capt. Pratt ...	12	M.	Genuine Cobra	Great toe left foot	0	30	$\frac{3}{5}$ grain divided over 13 doses.	Cured.
2	1893. August ...	Surg.-Capt. Vaughan ...	24	M.	Believed to be a Krait.	Ulnar edge of hand	1	15	$\frac{3}{5}$ grain ...	Do.
3	September	Dr. Reddie ...	13½	F.	Believed to be a Cobra.	Dorsum index finger. left hand.	1	30	$\frac{3}{5}$ " ...	Do.
4	November	Surg.-Capt. Drake-Brockman.	...	M.	Stated to be a Cobra.	Left foot below ankle	1	15	⅙ " ...	Do.
5	1894. February ...	Surg.-Lt. Col. O. Baker...	35	F.	Russell's Viper	Right ankle ...	1	30	$\frac{1}{10}$ " ...	Do.
6	May ...	Surg.-Capt. H. Smith ...	...	M.	Unknown ...	Toe	3	0	$1\frac{1}{5}$ " ...	Death.
7	June ...	Dr. Weatherley ...	45	M	Krait ...	Finger	1	0	$\frac{1}{12}$ " ...	Cured.
8	August	Surg.-Capt. Pratt ... Surg.-Capt. H. D. Paut...	25	F.	Unknown	Inner side, left arm, close auxiliary fold.	1	30	Over ½ grain...	Death.
9	October ...	Do. S. E. Prall ...	30	M.	Genuine Cobra	Right thumb and left index finger.	1	30	$\frac{3}{5}$ grain ...	Cured.
10	November	Dr. Jones	..	M.	Cobra ...	Right thumb ...	3	30	$1\frac{2}{7}$ " ...	Death.
11	Do. ...	Do.	13	F.	Krait ...	Do. little toe ...	1	30	$\frac{1}{7}$ " ...	Cured.

Table Z.—*Cases of snake bite treated in the Bhopawar Agency, Central India, reported through Surgeon Lt.-Colonel Joshua Duke.*

No.	Date.	Age.	Sex.	Snake.	Seat of bite.	Interval before treatment.	Strychnia used.	Result.	REMARKS.
1	1893 ...	Adult.	M.	Said to be water snake.	2 finger left hand.	Not stated.	$\frac{1}{10}$ Hypodermically. $\frac{1}{7}$ by mouth.	Cured ...	Snake probably harmless.
2	1893 ...	5	M.	Unknown ...	Foot	do.	$\frac{1}{20}$ grain ...	do. ...	Symptoms very slight
3	1893 ...	35	F.	do. ...	do.	1 hour.	$\frac{1}{10}$ ...	do. ...	Do. do.
4	1893 ...	30	F.	do. ...	Left toe ...	do.	$\frac{1}{5}$ " ...	do. ...	Symptoms marked.
5	1893 ...	...	F.	Said to be a black snake.	Not given ...	Not stated.	$\frac{2}{5}$ " ...	do. ...	Marked symptoms.
6	Sept. 9th, 1893.	28	M.	Cobra ...	Inner side left ankle	1 hour.	do. ...	do. ...	Severe symptoms.
7	Oct. 1893 ...	20	F.	Unknown ...	Inner side right ankle	4 hours	$\frac{1}{4}$ " ...	Death ...	Moribund when seen.
8	July 1894...	40	F.	Known to be a large cobra.	Finger right hand ...	½ hour	$\frac{1}{4}$ " ...	do. ...	Death 45 minutes after treatment.
9	July 10th... 1894.	Adult.	M.	Unknown ...	Ear	Not stated.	Not stated ...	do. ...	Moribund when seen.
10	Do. ...	do.	M.	Do. ...	Left foot ...	do.	do. ...	do. ...	Do. do.
11	July 12th...	5	M.	Black snake (killed) 3½ feet long.	Right foot base 2nd toe.	½ hour.	$\frac{1}{10}$ gr. in 2 doses V. each	Death in about 1 h. after bite.	Do. do. (Foaming at mouth.)
12	Oct. 11th...	Adult.	M.	Krait ...	Inner side left ankle.	3½ hours	$1\frac{1}{10}$ grain 3 qrs. reported	Death ...	Remedy failed
13	August ...	do.	M.	Black snake ...	Leg	45 min.	$\frac{3}{10}$ grain ...	Recovery.	......
14	September.	do.	M.	Green grass snake.	Back of hand ...	1 hr. 30 minutes.	$\frac{1}{10}$ " ...	do. ...	Snake probably harmless.
15	August ...	do.	F.	Daboia Russelli	Hand	Some hours.	$\frac{3}{10}$ " ...	Death on 3rd day.	After miscarriage.
16	Oct 1st ...	40	M.	Daboia ...	Ankle	½ hour.	$\frac{7}{10}$ " ...	Death ...	Death in 16 hours.
17	Oct. 30th ...	35	F.	do. ...	Not stated ...	Some hours.	Not stated ...	Death ...	After premature labour on 7th day.
18	Oct. 13th ...	60	F.	Not seen ...	Middle finger right hand.	30 min.	$\frac{1}{10}$ grain ...	Recovery.	When seen patient was insensible Did injection save life ?
9	1894. July 10th...	Adult	M. 19	Snake not seen bitten at night. Same snake bit both cases.	Left ear ...	Admitted 6 a.m. died 8 a.m., said to be moribund.		$\frac{7}{10}$ grain No spasm caused by strychnia.	In seven doses of M X each. Death at ten minutes interval foamed at mouth.
10	Do. ...	24	M.	do. ...	Left side six inches below armpit.	Admitted 2 a.m., died 3 a.m. said to be moribund.		$\frac{4}{10}$ grain no spasm caused by strychnia.	In 4 doses, at 10 minutes interval foamed at mouth. Death.
								Strychnia used.	
15	1894. August ...	32	F.	Symptoms—Inflammation and acute pain in hand, frequent vomiting.	None of patients insensible. Palm of left hand.	Snake in all cases Russelli Viper.		$\frac{3}{10}$ grain ...	2 doses M XV each. Death.
16	October 1st	40	M.	Do. do. leg, frequent vomiting.	Ankle left leg.			$\frac{6}{10}$ grain ...	2 doses M XV each, then XXX in two doses shortly before death.
17	Do. 30th	35	F.	Do. do. ...	Right leg.			$\frac{3}{10}$ grain ...	2 doses M XV each. Death.

No.	Date.	Age.	Sex.	Snake.	Seat of bite.	Interval before treatment.	Result.	REMARKS.
19	1st July, 1894.	30	M.	Snake seen by patient, black and hooded.	Toe left foot ...	Five minutes interval.	$\frac{4}{10}$ grain Spasms caused after 3rd injection.	Ran to hospital immediately, was then sensible, then had fits and convulsions, foamed at mouth. No treatment previously adopted.

On arrival at dispensary a ligature was applied and wound made to bleed freely. Ligature; strychnia M x. was used four times at intervals of ten minutes. Strychnia spasm observed after third dose.

The patient was walking in a field, felt a bite, and looking down is said to have found his toe in the mouth of a black snake. He jerked his foot sharply and threw reptile off, and then ran hard to hospital. Here is probably a case of recovery after true bite by a cobra.

Cases No. 9 and 10 were treated by the same hospital assistant, who thinks they might possibly have recovered if brought to hospital in proper time. Cases 9 and 10 were bitten at night when the men were asleep; no treatment was adopted until some time had elapsed and they were said to be moribund.

STRYCHNINE IN CASES OF SNAKE-BITE.

BY J. J. PRATT,

Surgeon-Captain, I. M. S.

DURING the past two years I have had the opportunity of applying the method of treatment recommended by Dr. Mueller in cases of snake-bite on two occasions.

The first case occurred at Fyzabad and was treated by Surgeon-Major Cadge, I. M. S., and myself. The particulars are as follows: Mahabir, a Hindu male, æt. 12 years, was admitted into the Fyzabad Sadr Dispensary about 7 A.M on the morning of the 26th July 1892. Patient was accompanied by his father, who stated that half an hour previously, when the boy was seated at his morning meal, a snake suddenly appeared and bit him on the great toe of the left foot. He (the father) at once enveloped his hand in a cloth, seized the snake close to its head, tore it from the boy's foot and hurled it to some distance, where it was promptly killed by a police constable. This statement was confirmed by other spectators. The snake, which was brought to the Dispensary with the boy, was a cobra, 3 feet 3 inches in length and of dark grey colour. The boy on admission complained of pain, tingling and numbness in the left foot. The surface of his body was cold, and he appeared to be a little drowsy, but there were no marked general symptoms. On examination of the foot a distinct puncture was found on the upper and inner surface of the great toe about an eighth of an inch from the edge of the nail. There was slight bleeding from the puncture and the skin immediately around it was ecchymosed. The toe was distinctly swollen. No second puncture could be discovered, this being probably due to the horny nature of the thickened epithelium of the part. A crucial incision was at once made at the site of the puncture, the wound washed with a strong solution of permanganate of potassium, and a bandage tightly applied round the leg above the ankle. Five minims of the ordinary pharmacopœial solution of strychnia were then injected hypodermically, and the injection repeated every five minutes. After the seventh injection patient was seized with tetanic spasms and vomited. Treatment was then suspended for the space of an hour and a half, when drowsiness became very marked. The injections were accordingly resumed at intervals of ten minutes, and after the sixth dose (being the 13th in all), when a total of 65 minims had been injected, a severe spasmodic fit came on. This was at 11-10 A.M. Between 11-15 and 11-45 A.M. a succession of severe tetanic spasms occurred, the muscles of the abdomen, back, and thighs being chiefly affected. The pulse became feeble and fluttering—140 to the minute, and respiration almost ceased. For a short time it almost appeared as if the patient were about to succumb to the effects of the "remedy." Small quantities of brandy and extract of chicken were administered, and swallowed with difficulty. Temperature taken and found to be slightly above the normal. Between noon and 1 P.M. patient's condition improved, the spasms being few and slight. In the course of the following hour they ceased entirely. Temperature taken at 3 P.M., 103°. Patient perfectly conscious and complaining only of the tightness of the ligature on his leg; foot much swollen. Nourishment taken in small quantities. At 6-30 P.M., the ligature was removed without causing any untoward symptoms. At 6 A.M. on the 20th the temperature was 101° and fell to normal in the course of the day; pulse good;

no pain. The swelling of the foot rapidly subsided; no further symptoms appeared, and the boy left the dispensary on the morning of the 29th July in perfect health, with the exception of a trivial wound on his toe.

The second case occurred in my own compound at Gonda and was treated by my Assistant Surgeon and myself. A Hindu female, *æt.* 25, the wife of one of my servants, was bitten by a snake about 2 A.M. on the 15th June 1894, whilst lying asleep on the floor of her house. The snake, described by the woman's husband as "kala," escaped. Assistance was not applied for until 3-30 A.M. (an hour and a half after the infliction of the bite), by which time the patient had developed marked general symptoms, notably drowsiness and loss of power in the legs, being unable to walk or stand by herself. Great pain was complained of at the seat of the bite, which was found to be the inner side of the left arm close to the posterior axillary fold. Two distinct punctures were visible about three-quarters of an inch apart. The surface of the skin was cold and clammy; the pulse feeble; respiration slow and sobbing. 3-45 A.M. $\frac{1}{15}$ gr. of strychnia injected hypodermically and patient sent on to the sadr dispensary for treatment to be continued. 4 A.M. Patient arrived at dispensary; insensible; profuse salivation; hands and feet cold; conjunctivæ congested; pupils normal; pulse feeble. 15 minims of the B.P. solution of strychnia at once injected. 4-15 A.M. No improvement; pulse feebler and slower; breathing stertorous; face becoming cyanosed. Injection repeated. 4-30 A.M. Face and hands markedly cyanotic; pulse feeble and at times intermittent; surface of body cold; respirations six to the minute. Injection repeated. 4-45 A.M. died. Three days later a large cobra was killed in the hut in which the woman had been bitten.

The first of these cases is complete as far as it goes. The snake was produced with the patient; strychnia was administered in what under ordinary circumstances would be regarded as dangerous, perhaps deadly doses; the symptoms produced by the drug were for a short time alarming, but soon passed off, and the boy made a rapid recovery. The only element of doubt attaching to the case is whether the bite inflicted by the snake was really an effective one. Only one puncture was discovered, and the quantity of venom injected may have been small, or one may go even further and suggest the possibility of the cobra having bitten without injecting any poison at all. It is possible that many authentic recoveries, supposed to be due to the administration of antidotes, are really due to the bites not having been vicious.

The second case was unsatisfactory from the commencement. The period which had elapsed before medical aid was sought, and the position of the bite in close proximity to the trunk, were unfavorable to the successful adoption of any line of treatment. No ligature could be applied above the bite and the patient's condition showed it to be certain that local treatment would be of no avail. Within the short period of an hour, more than half a grain of strychnia was administered without the slightest sign of even temporary improvement. Perhaps the doses should have been larger.

My mind remains open on the question of the efficacy or inefficacy of Mueller's method of treatment. I always look forward with interest to accounts of cases in which it has been adopted by other medical men, and shall not hesitate to give it a further trial myself should the opportunity offer. In view, however, of the many doubtful cases which have been published, I wish to close my paper with a humble expression of opinion to the effect that the great majority of cases of so called "cure" of snake-bite, in which the offending reptile has neither been killed nor captured and subsequently identified by competent authority, are of absolutely no scientific value.

DISCUSSION.

D. N. Roy (Calcutta) remarked that Drs. Banerjee and Duke had spoken in almost unmistakeable terms of the efficiency of strychnia in the treatment of snake-bite; but that Dr Pratt seemed doubtful on the subject. Also that Dr. Cunningham, from his experiment, had given many hints as to how fallacies might arise; and hoped that those who might in future carry out experiments on the subject would bear Dr. Cunningham's remarks in mind.

PERMANGANATE OF POTASH AS A CHEMICAL ANTIDOTE IN THE TREATMENT OF POISONING CASES.

BY S. P. SARBADHIKARI.

IN a country like India, where cases of poisoning, whether suicidal, homicidal or accidental, is a matter of daily occurrence, any antidote which is in itself more or less harmless, and yet capable of wide application in some of the commoner forms of posoning, is to be welcomed. I believe permanganate of potash is a substance of this description, as I shall try to show in the course of my remarks.

Foremost among the substances which claim a very large proportion of mortality from poisoning is *opium.* This poison is most commonly taken in the crude form for suicidal purposes and comparatively rarely as morphia hydrochlorate or acetate, both for homicidal and suicidal objects.

As regards opium in the crude form: Within the last ten months, I have had opportunity of treating four cases, of which the following are short notes :—

Case. 1—A Hindu male, æt. 44 In consequence of a family dispute he took 72 grains of crude opium, after having fasted for 36 hours. I saw the man eleven hours after the taking of the poison. Condition at the time was apparently one of the last stage of opium coma, with shallow respirations at the rate of three per minute, pulse feeble, thready, uncountable and barely perceptible. Death looked imminent; in fact it was with great diffidence that I undertook the necessarily long continued stomach pumping. I commenced treatment by washing out the stomach with large quantities of dilute Condy's fluid (strength 1 in 30), not only till all visible solid matter in the washings ceased, but till the washings returned with the usual pink colour of diluted Condy. The process took an hour and a quarter, in the course of which I had often to remove the stomach pump tube, as the patient apparently looked dead. On these occasions, artificial respiration, and galvanism patiently tried, started the respirations, and the washing was resumed. At the conclusion of the washing by Condy the stomach was cleaned out of all permanganate with plain water, and then a definite quantity of the drug (4 grains) in the shape of two ounces of Condy's fluid diluted with four times as much water was put in and left in as a reserve to meet and neutralize any opium that may have been accidently left in. The quantity of opium washed out, even after eleven hours of absorption from an empty stomach, was considerable. Artificial respiration alternating with galvanism and hot coffee injections into the rectum followed the washing. Respiration improved to five per minute within an hour of the washing, when other two grains of permanganate were put into the stomach diluted with some warm milk through the stomach pump tube, the dose being repeated two hours after, making in all, eight grains of the drug left in the stomach, besides the large quantities that were merely passed through. In six hours from the time the washing was finished, the respiration rose to sixteen per minute, the pulse improved markedly, the man recovered consciousness and was able, by gestures and a broken word or two, to call for a drink of water, which was given and swallowed easily. For the next hour all seemed to be well and complete success seemed apparent, when, without any notice, the breathing rapidly increased to thirty-two per minute and the pulse commenced to sink again, while the first sound of the heart became imperceptible. But strangely enough for a case of opium poisoning, consciousness was not lost, but began steadily to improve. Heart failure had evidently set in inducing cardiac dyspnœa. Hypodermic injections of strychnine and ether were tried but to no purpose. The man died eleven hours from the time I saw him, but was fully conscious to the last, being perfectly rational.

Post mortem examination shewed no opium in the stomach and intestines, and only minute traces in the liver and kidneys. The heart was in a very advanced stage of fatty degeneration. This, coupled with the prolonged starvation to which the man had put himself before taking the poison, explained the death from cardiac failure. Although in the long run this case terminated fatally from a cause totally unconnected with opium poisoning, I submit that the results following the permanganate treatment were sufficiently encouraging to warrant persistent efforts in this direction.

Cases 2, 3 and 4 were in three adult Hindu females, who had taken 60, 130 and 96 grains of crude opium, respectively. The first one only on an empty stomach. The last two had undigested rice in the stomach at the time of the washing. I saw these cases from four to twelve hours after the taking of the poison, every one of them being in the stage of very far gone coma. The same sort of treatment as in case No. 1 was followed. The maximum quantity of permanganate administered through the stomach pump tube from time to time during the stage of coma was sixteen grains, and the minimum six grains, according to the dose of the poison. No other antidotes were used, all the concomitant treatment being by artificial respiration, galvanism and rectal injections of hot milk and coffee. All these three cases recovered.

As regards morphia.—I treated one case of poisoning by this drug a month ago. The quantity taken could not be ascertained. But this patient, too, was in an advanced state of coma, though the respiration had not gone down lower than five per minute. The same mode of treatment was adopted with complete success.

You will observe that I purposely reserved really bad cases only for this treatment, not feeling justified at the outset in experimenting with promising ones. Nor was any other chemical or physiological antidote used in any of these cases to complicate matters. Of course it may be argued that success in these cases might have been quite accidental. But even an accident that happen so frequently is one that should arrest the attention of all thinking men. But, coming to look at the thing attentively, it does not look so much of an accident. It has been found by Dr. Moore, by experiments in the laboratory, that four grains of permanganate of potash will neutralize a grain of hydrochlorate of morphia, so that the mixture may be swallowed with impunity. I admit that the difference between experiments conducted inside test-tubes in a laboratory and the changes going on in the stomach, tissues and fluids of a comatose patient, are enormous; yet, with sufficiently large doses of a highly oxidising and diffusible substance like permanganate of potash, judiciously given, according to the doses of the poison taken, it does not seem impossible that we can arrive at the conclusion which the few cases I have cited seem to suggest.

Strychnine—I shall next relate a remarkable case of *strychnine* poisoning, similarly treated, with success:—

A Hindu female, aged 19, took 10 grains of the hydrochlorate of strychnine with about 1½ chittacks of water at 9 A. M. on the 13th April, the object being to commit suicide. The poison was taken on empty stomach. In less than five minutes from the swallowing of the dose muscular twitchings all over the body came on and strong general convulsions came on soon after. Her friends noticed her condition about twenty minutes after the taking of the poison, when the patient informed them as to what she had done. I saw her three-quarters of an hour after the poison had been swallowed. I found her in a well-marked opisthotonic condition. She was conscious, but unable to speak from the set condition of the jaws. Strong clonic general convulsions were coming in quick succession, and lasted for two or three minutes with intervals of a few seconds. Fibrillar movement of the muscles were noticed all over the body, even during the intervals. The pupils were strongly contracted. The pulse was small and quick, scarcely felt during the height of a paroxysm. The respirations were short, quick, spasmodic, accompanied with a feeble stridulus and altogether suspended during the height of convulsions. The face was deeply cyanosed. There was no frothing at the mouth nor biting of the tongue. There was cold perspiration on the face, forehead and chest. Any effort at opening the eyelids or the jaws, or attempt at swallowing, brought on the most violent convulsions, which were of a distinctly clonic character. No complete muscular relaxation was noticed even in the intervals.

I put thirty grains of hydrate of chloral, and the same quantity of bromide of potash dissolved in 1½ ounces of water into the rectum. The introduction of the nozzle of the syringe into the anus brought on violent spasms; so I waited till the paroxysm passed off, and then gently pushed the piston home. The injection was fortunately retained. Then, taking advantage of a quiet interval, I slipped in a wooden gag between the molar teeth and tried to pass the stomach pump. No sooner had the end of the tube touched the pharynx than the most fearful spasms threatening to kill the patient outright came on, and the jaws set so firmly as to crush the wooden gag and bite off the tube of the stomach pump. The patient was next put deeply under chloroform, and the bit-off end of the tube was removed. A second tube was fortunately soon available. The contents of the stomach were drawn off and found to consist only of three ounces of a slightly turbid liquid, having a few flakes of mucus in it, there being no trace of food of any kind. This liquid was subsequently analysed, and gave all the reactions of strychnine. Two ounces of Condy's-fluid with four of water were put into the stomach with a flute-key pump, and the fluid well agitated by working the piston up and down. The stomach was then moderately distended with water, the fluid was again well stirred up and then pumped out. The fluid came out quite discoloured. The washing was repeated with large quantities of diluted Condy's fluid 1 in 8, till the fluid came out with the usual pink colour. The stomach was then washed out with plain water. A solution of two drachms of Condy's fluid in two ounces of water was then pumped in and left in. The washing out with plain water at the last was to make sure that only a certain known quantity of permanganate of potash were left in the stomach. The whole process took a little over half an hour, during which the patient was under chloroform. On completion of the washing thirty grains each of the hydrate of chloral and bromide of potash were injected into the rectum.

Patient recovered from chloroform in four or five minutes, and had no convulsions for two hours, when they commenced again. She had six comparatively slight fits in the next twenty-four hours, coming on after gradually increasing intervals, ranging from one to three hours. These were met by rectal injections of bromide and chloral, varying in doses twenty to ten grains of each. The total quantity of chloral and bromide used in twenty-four hours was 150 grains of each, of which forty grains each were by mouth when deglutition became possible after fourteen hours, the rest being by the rectum. Whiffs of chloroform were also given at times.

Patient passed six ounces of urine at 6½ P.M., and had a stool consisting of mucus at 7 P.M.

Alimentation was by rectum for fourteen hours, and consisted of two or three ounces of milk with an ounce of Brand's essence of chicken every two or three hours. After fourteen hours patient could swallow very small sips of iced milk.

Second day.—Had three slight and three rather violent fits. Intervals getting longer.

Total quantity of bromide used (by mouth) on this day was seventy grains, and of chloral there were fifty grains used.

Third day.—Four slight spasms.

Chloral used ...	... 30 grains.
Bromide ...	... 50 „

Fourth day.—No spasms. Only slight reflex irritability.

Chloral used ...	... *nil.*
Bromide ...	... 40 grains in 2 doses.
Total quantity of chloral	... 220 grains.
Total „ „ bromide	... 240 „

Temperature.—Rose to 99·8° F. on the first day, but fell to normal the next day and kept so after that.

Remarks.—The case is perhaps worth putting on record, as the use of strychnine for purposes of suicide is infrequent in India. Strychnine-poisoning in India is generally accidental, the drug being mistaken for santonin.

A case of recovery after swallowing on an empty stomach ten grains of a drug of which quarter grain is the minimum fatal dose is also, perhaps, noteworthy.

With regard to the dose of potash required to neutralize the strychnine inside a test tube, six grains of permanganate will do little more than neutralize a grain of strychnine. Of course the quantities required in a given case of poisoning will be more than this, according as the stomach was empty or contained organic matter in the shape of undigested food particles.

I admit that in this case chloral and bromide were used as adjuncts in the treatment. Being the first case of its kind, and having regard to the severity of the symptoms, I did not feel justified in withholding these drugs for experimental purposes.

Belladonna.—Next as regards *belladonna:* I have had no cases in human subjects, but I have experimented with animals. Five grains of permanganate of potash will neutralize a grain of atropine in a test tube. Mixture of this description given *slowly* to a young cat in the course of two hours, mixed with milk, proved inert, no effect being noticed on the pupils, nor were there any other visible symptoms, the animal remaining healthy for the next three days. The animal was kept fasting for a day, after which it was given half a grain of atropine in some milk. In four minutes' time the pupils dilated widely. Three minutes later the animal began to pant visibly and had a staggering gait. It was then seized, and four hypodermic injections (to make up 2½ grains of the permanganate) were put into different parts of the body at intervals of an hour, while the stomach was rapidly washed out with a No. 7 soft catheter and a glass syringe. The animal remained dull, dazed and panting for three days, after which it seemed to regain its normal state, though its gait remained slow for days afterwards, and the pupils did not contract till eighteen days after. This experiment has been repeated twice under the same circumstances and with the same results. If however the washing of the stomach is delayed longer than twenty minutes the animal dies, as in the case of a cat which had been given a grain of atropine and was not washed out till twenty-five minutes after.

I am conscious that these experiments are very far from being convincing, so far as the human subject is concerned. But perhaps they point to the possibility of giving good results if tried in a case of belladonna poisoning in man.

Dhatura.—I have had no opportunities of trying this treatment in cases of *dhatura* poisoning. Nor have I experimented in this direction. But, by analogy, what is true of belladonna ought to prove true of *dhatura*, which is a poison very widely used throughout India. Of course the form in which this drug is administered makes it difficult for the permanganate to permeate the poison readily. But prolonged soakage with the diluted Condy in the stomach may be expected to effect some good.

Ptomaines.—If it is true that ptomaines are cadaveric alkaloids, indistinguishable in their chemical and physiological properties from alkaloids derived from vegetables, the oxidising properties of permanganate of potash ought to have the same effect on them as it has on morphia, strychnia, etc. Now that cases of ptomaine poisoning are frequently cropping up in medical and medico-legal literature, I beg to throw in the suggestion of the use of permanganate of potash in these cases. It may well be administered in pill-form (one to three grains) preceded by an emetic.

Summary.—To sum up: Having regard for the facts here set forth, I beg to submit that a fair case has been made out for the proposition that a wider trial of the permanganate of potash in cases of poisoning by morphia, strychnia and atropia, possibly *dhaturine* and other alkaloids, as well as the crude drugs which yield these alkaloids, should be made. I beg to append a few practical hints as to the use of the drug:—

I.—It be made a rule in the cases detailed above that the washing-out of the stomach be not commenced with hot water as usual, but with hot water having in solution some permanganate of potash. The use of plain hot water may assist in the absorption of the very poison we want to eliminate, by bringing the poison into a state of more complete solution ; and the time required for the complete washing-out of the stomach favouring the absorption. If, however, there were some permanganate of potash in the water ready to attack the posion and to neutralize it, as it comes into solution, this danger is avoided.

II.—The washing must be continued not merely till all visible solid matter is absent, but till the fluid returns in its usual pink colour time after time. Large quantities of Condy have been used in this way. I have used six to eight ounces, largly diluted, for washing purposes in this way, with the best of results.

III.—After the washing with diluted Condy is finished, it is good to wash-out with plain tepid water, so as to remove all the permanganate, and then to put in a definite quantity of the antidote to counteract any poison that may have remained in the stomach, or passed down into the intestines, or may get eliminated into the intestinal tract. In this connection, it should be remembered that six, five and four grains of the potash will neutralize a grain of strychnine, atropine and morphine, respectively, inside a test tube. The quantities of Condy used in washing-out, and the quantity of permanganate to be left in the stomach and repeated as required, will have to bear some ratio to these figures.

IV.—The concomitant treatment, appropriate to each case, should not be neglected ; and the permanganate of potash treatment should be looked on only as a valuable adjunct.

DISCUSSION.

K. K. Soshi (Bhopal) remarked that he had had sixty cases of datura poisoning at the Prince of Wales' Hospital, Bhopal, last year. They used to come in groups of 8, 10, and 12 ; the poison having been administered in public places, and they were brought in by the police, eight to ten hours after the administration of the drug. They were then quite stupid with widely-dilated pupils and not able to speak—throat dry. He washed out the stomach with tepid water, gave 15 minims of tincture opii by the stomach, and repeated it after four hours if necessary. Also a hypodermic injection of morphia was given at the commencement. As a rule they came to their senses partially after six hours, or at latest four hours after a second dose of 15 minims of tincture of opium. He thought opium was the proper remedy for datura poisoning.

R. N. Roy (Calcutta) remarked that Dr. Sarbadhikari had had recourse to other potent measures, as artificial respiration, galvanism, and coffee, besides the permanganate of potash, Also that the author advocated the washing out of the stomach with the salt until the washings presented the bright colour of permanganate solution, and thus indicated that the stomach was free from organic matter ; in fact it was an *efficient* washing-out of the stomach.

A NOTE ON SOME CASES OF POISONING BY SCOPOLIA LURIDA.

BY A. MACNAB,

Surgn.-Captain, I. M. S.

BELIEVING that few, if any, cases of poisoning due to this plant have yet been recorded, and in view of the possibility of an occurrence of the same kind as that which I am about to relate under similar circumstances, I am led to think it worth while to give the following account of an incident that occurred during the Black Mountain Campaign of 1891, and to furnish a description from notes made at the time of a series of serious symptoms that rapidly supervened after the leaves and succulent stalks of *Scopolia lurida* had been eaten by mistake for a very similar and quite harmless plant known to Gurkhas as tambáku sag or taringa.

It seems to be an accident that might well happen again, for from the account of the men who, deceived by its similarity to the herb which they are accustomed to gather and eat with their food in their native hills of Nepal, partook of the plant in question and were poisoned, there is a very great resemblance between the two.

On the night of May 20th, 1891, I was summoned by the hospital assistant of my regiment then in camp at Seri on the Black Mountain, to the lines of No. 5 Company Gurkhas, being told that seven or eight men were lying in various degrees of delirium and unconsciousness, which had come on shortly after they had eaten their evening meal. On reaching the tents, I found a havildar and seven men, all Gurkhas, suffering from a series of symptoms, which were very distinctive of belladonna poisoning, *viz.*, marked dilatation of pupils, a feeling of constriction in and dryness of the throat, a peculiar variety of fussy delirium with hallucinations, and loss of the power of co-ordination in the lower extremities. Ascertaining that all had eaten the leaves and stalks of a plant they called tambáku sag, which had been given them by some men of their own company on picquet some 1,500 feet higher up the hill, where they had that afternoon been to visit, I examined at once a specimen of the plant lying near, and from a certain resemblance of the leaf to that of belladonna and that of the symptoms to those of belladonna poisoning, I first thought it might be a variety of that plant, and after giving each man 60 grains of zinc sulphate, which produced emesis in every case, I administered morphine hypodermically to the two worst cases and had all taken to the nearest field hospital. Arrived there, the next three hours were employed in giving ammoniæ carb. to produce emesis, and in then keeping the men constantly moving. This treatment answered very well, and by 2-30 A.M. all were in a condition, which permitted of their being put into tents, a careful watch being maintained upon them. The havildar, who throughout seemed least affected, returned to the regiment next day and the remaining seven men the day following. I examined all on the day on which they returned to the regiment, and found they were still suffering from various degrees of dilatation of the pupils, inability to accommodate and giddiness. All these symptoms, however, entirely disappeared in a day or two, and the men were sent back to duty. Their symptoms from the beginning and more in detail were as follow :—Some 15 minutes after first eating the herb they said that they began to experience a feeling of constriction in and dryness of the throat, soon amounting to an inability to swallow, rapidly succeeded by a sense of muscular weakness and tremors so marked that they found themselves without sufficient strength to continue breaking and eating their chapatties;* giddiness and inability to stand upright was next experienced, and finally the condition of delirium and semi-consciousness supervened in which I found them. To this it may be added by way of fuller description that most of them were unable to answer when spoken to, and those who could had forgotten their own names. Some lay on the ground in a dazed condition, others sat up constantly making fidgetting movements with their fingers, picking up small particles of sand or pebbles from the ground, or appearing to be searching for something they had lost, and occasionally looking up with a half vacant, half-wild expression. In none was there anything approaching a state of collapse; the pulse was good, if a trifle rapid; in all respiration was never stertorous; no pain was complained of save the dryness of the throat and the painful sense of constriction. The mouth was dry and salivary secretion arrested. They exhibited all varieties of gait, from trifling unsteadiness to complete loss of control over their lower limbs.

It being dark and all quiet in camp and the men being together their condition for some time escaped notice, and it was not until nearly three hours had elapsed after eating the herb that I was called to them. It seemed fortunate, therefore, that their condition had not become more serious. Four had vomited before the emetic was given them; only one had passed urine before losing consciousness, and then in small quantity and with some amount of strangury. I very much regret that I am unable to show a specimen of the plant, which, however, was submitted for identification at the time, and presumed, without much doubt, by an experienced botanist to be *Scopolia lurida*. The plant grew very locally at an elevation of 7,000 to 8,000 feet, and occurred rarely. The plant for which it was mistaken is, the men say, very similar in appearance, and is known by them in Nepal as taringa or tambaku sag. There is said to be this important difference, *viz.*, that the stalk of tambaku sag is hollow, while that of *Scopolia lurida* is certainly solid and succulent; but, never having seen the plant, I am unable to speak with certainty on this point, and had I thought of it before, I would have tried to procure a specimen for comparison, and much regret that the interest, if any, of the note should be so greatly lessened by the want of specimens both of tambáku sag and *Scopolia lurida*.

DISCUSSION.

D. N. Roy (Calcutta) said that *Scopolia lurida* was a new poison brought to the knowledge of the profession. It was known that belladonna grew wild on the Himalayas, but that as Dr. Macnab had given the altitute at which *Scopolia lurida* grows, and also its botanical characters, we had no reason to think that it was belladonna.

"SUI" OR NEEDLE POISONING IN THE PUNJAB IN CATTLE.

BY G. D. MALL.

THIS method of poisoning in the professional technology of the poisoners is called "thakea," *i. e.*, bypake. It consists of introducing under the skin or other parts, such as tongue, throat, rectum, and in female animals in vagina, generally of small pointed solid bodies like spikes called "suis" or needles. These "suis" are commonly made of *Abrus precatorius* (jequirity) seeds called in vernacular "ratti" or "lálri." These are commonly used by jewellers as small weights. To the fine powder of these seeds, which is sifted so as to remove their red or black coverings so that they may escape visual detection, water is added to bring it to the consistency of a paste. Sometimes the seeds are soaked so as to decorticate them easily. The paste thus prepared is moulded into small spikes named "suis." These are then exposed to the sun to get them dry and hard. The "suis" made in the above-quoted manner are found generally to measure from 1 to $1\frac{1}{2}$ inches in length, and $\frac{1}{5}$ or $\frac{1}{6}$ of an inch in diameter at the base. Such "suis" are also made with arsenic. The other kinds of "suis" are described under the heading "modes of poisoning." This kind of poisoning is commonly observed in cattle, and very rarely in human beings. Animals are generally poisoned by low caste persons, such as sweepers in this province, for the sake of their hides. They generally poison animals without regard to their value, with the hope to get two or three rupees for each skin. The finest and fattest animals are generally killed, because a good heavy hide brings a few annas more into the poisoner's pocket than a hide of less weight. In most cases sweepers poison animals in order to clear advances of money which they receive for this purpose from leather tradesmen, but sometimes the act of poisoning is done from revenge or spite. In this country loss of horned animals is more felt than in other countries, where horses are used for tillage, because here horned cattle are the animals which are used for the purpose of cultivation. The destruction of cattle in this way has been found in some cases to bring hardships for husbandmen. This subject will be briefly described here under the following heads:—

I. Modes of poisoning. II. Symptoms. III. Treatment. IV. Manner of examining bodies of animals supposed to have been poisoned by suis. V. Nature and identification of substances generally used for needle poisoning. VI. Statement shewing the cases of needle poisoning during the last four years, *viz.*, 1890, 1891, 1892, and 1893.

I. Modes of poisoning.—The ways adopted in this province for poisoning cattle by means of "suis" are the following:—(1.) The most common method is as given below. Poisoners generally keep small "suis" made of ratti wrapped in cotton in a hollow reed about 4 or 5 inches long. When they require to use it, they fix one of the needles in a small cavity at the end of the reed or at the end of a solid stick about 3 or 4 inches long and three-quarter inch thick. It is sometimes secured there by putting around its base a small quantity of kneaded flour. After the needle is mounted in the way above described, it is forcibly thrust into the skin or other easily penetrable parts, such as tongue, mouth, throat, rectum, or about genitals in the female animals. In some cases more than one blow is required to effect penetration, because more than one puncture is observed in some hides, especially those of buffaloes sent for examination to this laboratory. In cases in which penetration occurs, half an inch to one inch of the solid "sui" breaks off and remains in the wound. It is found that ratti paste introduced in the body of an animal in the above-quoted way generally causes death, though given to animals in food hardly proves injurious. 2. (*a.*) The next common way of poisoning subcutaneously is that a poisoner takes a painted stick about a foot and a half in length. The pointed or tapering end of the stick is often found notched in order to assist adhesion of a paste generally made of pounded croton seeds. In one case croton paste was found to have hair and pounded charcoal in it. It is usually thrust up the rectum in order to penetrate it. It causes death generally by peritonitis set up by the irritant left in the wound. (*b.*) In some cases the stick is thrust through the mouth into the throat. It then produces death by suffocation due to diffuse inflammation set up near the glottis. (3.) In other cases it is found that the poisoners have a kind of awl or an ordinary big sewing-needle tipped with poison, with which they wound the tender parts of an animal so as to draw blood. In this way poison comes in contact with the blood, pervades the whole system, and brings on, in most cases, the poor beast's death. (4.) Another method is that, with an ordinary needle or cobbler's awl, a puncture is made in some part of an animal's body and a "sui" is introduced. (5.) Sometimes a ball of cotton soaked in some poison is fixed at the end of a stick and thrust into the rectum or vagina. The ball is left there and the stick is withdrawn. If it is thrust with force, it sometimes makes a puncture there. Such balls on analysis have been found to contain in them pounded chillies, madar juice, or ratti paste.

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* Chapatties are pancakes made of flour and clarified butter (*ghi*).

II. *Symptoms.*—Symptoms observed in animals poisoned in the ways above mentioned vary according to the parts punctured and the poison used. A very small quantity of poison introduced into the body of an animal in the ways above-quoted generally causes death; for example, in a kid $1\frac{1}{2}$ grain of powdered ratti paste introduced subcutaneously causes its death in 50 hours.

The poison in some of these cases appears to act as a permanent as well as a local irritant, causing death in periods varying in different cases. At the seat of injury œdema of subcutaneous tissues is observed. if the puncture is made in the skin; if it is near a joint, the animal limps, and then lies down and seldom leaves the place. If the tongue is punctured, there is difficulty in swallowing, yellow fluid comes from the mouth and nostrils, and the animal refuses food. If the throat is punctured, besides frothing at mouth, there is heard a rattling noise; the throat is found smaller and the breathing is heavy. There is generally great depression, drowsiness, and exhaustion. The *period* of death which has been reported in cases of "sui" poisoning sent here for analysis varies a great deal. For instance, in a case from Rawalpindi received in March 1890, an animal which was punctured in the tongue and palate died in 28 hours. Another case from Hazara, in which a needle is said to have been thrust in the head of a buffalo, death took place after five days. In a case from Hazara received in January 1891, an animal in which a puncture was made in the tongue, death took place in eight days. In another case from Shahpur, received for analysis on 16th October 1890, a puncture with slough was observed. The animal died in $12\frac{1}{2}$ days. In another case, reported from Gurdaspur in 1892, in which a needle was found in the neck of the animal, death occurred in 15 days.

III. *Treatment.*—Before a needle softens and becomes active the animal may be saved. It can be felt as a small hard lump under the skin for some hours after introduction. The spot is easily recognised by the animal shrinking from pain if it is pressed. A free incision should be made in the skin and the wound thoroughly scraped and washed out. In cases of rectal and vaginal poisoning, attention is drawn by the irritation about these parts. The poisoned ball of cotton can be readily taken out by the finger or hand. There is always some interval before the dried cotton ball becomes softened and active. In cases where a needle is inserted in the mouth and tongue, these parts should be carefully examined. In one case a mare worth Rs. 300, belonging to Surgeon-Major D. St. J. D. Grant, was saved by extraction of a needle which was thrust into the back of her tongue.

IV. *Manner of examining bodies of animals supposed to have been killed by needle poisoning.*—When a poisoned animal is to be examined, one should very carefully look for a puncture or punctures in the skin or other parts. In buffaloes they are readily seen, but with difficulty in cows. The skin should be thoroughly washed. The punctured portion is known by redness and inflammation in and about it, and watery or bloody fluid oozing from it. If a dark or white body, *i.e.*, an entire needle or a portion of it is seen in it, it should be carefully kept for examination. If no puncture is visible in the skin, the mouth, rectum, and genital organs in female animals should be searched, and if any foreign substance is found, it should be preserved for analysis.

V. *Nature and identification of substances generally used for needle poisoning.*—The ratti seeds of which "suis" are generally made can easily be identified. The varieties are black, white, and red. If a powder of them is sent for examination, then they can be recognised by the fragments of cortex. The composition of "suis" made of ratti is indicated by means of the microscope and physiologically. The cells of ratti seed have a peculiar appearance. They have very thick walls, through which processes of protoplasm pass from the interior of one cell to that of the next one. These can be compared with a specimen freshly prepared in a laboratory. If croton paste is used, it is distinguished by washing with ether ; by allowing the ether to evaporate spontaneously, an oil is obtained which blisters the skin. Arsenic is known by Reinsch's and other tests, and aconite physiologically. For madar juice there is no chemical test ; it is known by its physical appearance and physiological effects.

The crime of cattle poisoning by means of "suis" is very common in this province, as is shewn by the statement overleaf.

Note.—It would not be out of place to mention here that a case of poisoning by needle in a human being was brought to notice in November 1893.

This occurred at Pindi Gheh in the Rawalpindi district. A woman by the name of Mussamat Bukht Nur, about 30 years old, was said to have been wounded by a poisoned "sui" (big needle) near her right breast. On examining her, there was found a wound near her right breast about the size of a four-anna bit. She suffered from cough, pain in and around the injured spot ; afterwards, from delirium, stertorous breathing, collapse, coma, and death. She lived eight days after the infliction of the wound with the "sui."

Post-mortem appearance.—The injured spot was found to have turned into an ulcer, almost filled up. The skin around it was œdematous. The internal examination showed congestion of the brain membranes and of left lung. Right lung was found consolidated. Pericardium was full of liquid, heart flabby, and large ante-mortem clots were observed in it. Stomach was empty. Hæmorrhagic spots were observed under the mucous membranes of stomach and intestine. The Assistant Surgeon, under whom the case under reference was, taking into consideration the symptoms and *post-mortem* appearances, concluded that it was probably a case of blood poisoning. The chemical analysis of the piece of skin and of subcutaneous tissues from the front of the chest where "sui" was said to have been thrust did not give any evidence of the use of any particular poison, but an extract prepared from it when injected into a frog caused its death by paralysis within three-quarters of an hour.

A REMARKABLE CASE OF QUININE POISONING.

BY A. E. ROBERTS, M. B.,
Surgeon-Capt., I. M. S.

As far as I can ascertain the subject of poisoning by quinine has not received much attention from medical authors,—at any rate I have not been fortunate in my researches into medical literature in obtaining light and leading upon this subject. I am therefore impelled to put the following case on record as one of remarkable interest in many ways.

Mrs. ——— Eurasian, 35, married, no children, in comfortable circumstances, had always enjoyed good general health, but had been troubled for nearly two years with menorrhagia associated with slight uterine retroflexion. This local trouble had been temporarily overcome by treatment, and she had normal periods for three months, when at noon on a certain day in November 1893 I was suddenly summoned to her bedside, as she was declared to be dying. On my arrival I heard that she had swallowed a very large dose of sulphate of quinine an hour or so before, and from the evidence available, which I carefully and critically weighed, I believe the quantity to have amounted to about six drachms. There is no doubt in my mind that she managed to swallow fully five drachms, and there were traces of a little in the vessel from which she drank it, and on her lips, at the time I first saw her.

She was lying upon her bed totally unconscious—an inert paralysed mass. The whole surface of her body was deadly cold and blanched, or rather livid ; her temperature (axilla) 95°, breathing almost imperceptible, shallow, slow , pulse 45, thin and small. Her eyes were closed, pupils considerably dilated, no response to light ; tendon reflexes not obtained, no response to external stimuli ; and save that she at long intervals uttered a low groan, she appeared to her friends to be dead. My own anticipations were *not* cheerful.

There was little, if any, change in her condition for several hours, during which she vomited "coffee-ground substance" several times. Indeed definite and obvious signs of rallying were deferred until the early hours of the next day, and it was then ascertained that, in addition to slight deafness, she was "stone blind," even to total non-appreciation of strong sunlight. The deafness gave no trouble ; perfect hearing was restored within a week with the gradual return of general functional activity, but it was long ere all traces of the tremendous shock to the general system had disappeared, and doubtless the demoralization induced by the blindness and the terrible circumstances served to accentuate the profound debility.

I have said that at first the pupils were widely and equally dilated, and did not respond to the stimulus of light ; the blindness was the dense, uncompromising darkness of atrophy. It was not until 48 hours had elapsed that I found an opportunity of using the ophthalmoscope, and the picture I obtained was definite and well marked. There was a blur or haze over the whole perceptible retinal field, there was a distinct deepening of colour (congestion), especially concentrated in the macula ; the discs were not definitely altered in colour, but, if anything, perhaps also of a slightly deeper tint than normal. (I speak under reserve, as I am not very familiar with the exact shade of the Eurasian disc), but hazy and with ill-defined margins. I can think of nothing more suggestive as an indication of the impressions I received during the first examinations than a rather highly colored and crude water-colour sketch which had been very slightly smudged, perhaps I may call it "smoky," so that the contours of the vessels were blurred and not well defined. However this stage was of short duration. The tint of congestion and the blur alike disappeared, and in a week from the onset, I began to fear that optic atrophy would close the scene.

Statement showing "sui" or needle poisoning cases in cattle received for analysis from different districts of the Punjab during the years 1890-91-92 and 1893.

Year.	Total No. of cases of sui poisoning in cattle referred for analysis.	Number of cases in which puncture was observed	Position in which punctures were observed.						No of cases in which puncture was not observed.	No. of cases in which poison was detected	Nature of poisons detected.								No. of cases in which poison was not detected.	Remarks.
			Tongue	Flesh	Skin.	Vagina.	Rectum.	Throat.			Arsenic.	Ratti paste.	Ratti and copper.	Croton paste.	Madar juice.	Aconite.	Red lead.	Capsicum and ratti paste.		
1890	32	26	10	10	2	...	2	2	6	2	...	1	...	...	1	...	...	...	30	......

In 1890, 32 cases of needle poisoning in cattle by "suis" referred to for analysis. Out of these, in 26 cases punctures typical of needle poisoning were observed, giving a percentage of 81·25. In 10 cases puncture was observed in tongue, in 10 in flesh, in 2 in skin, in 2 in rectum, and in 2 in throat. In 2 cases only poison was detected. In one case ratti paste was found, and in the other madar juice. The percentage of poison was very low this year. It amounted only to 6·25 per cent.

Year.	Total No. of cases of sui poisoning in cattle referred for analysis.	Number of cases in which puncture was observed	Tongue	Flesh	Skin.	Vagina.	Rectum.	Throat.	No of cases in which puncture was not observed.	No. of cases in which poison was detected	Arsenic.	Ratti paste.	Ratti and copper.	Croton paste.	Madar juice.	Aconite.	Red lead.	Capsicum and ratti paste.	No. of cases in which poison was not detected.	Remarks.
1891	38	30	22	3		3	1	1	8	7	2	2	...	1	.	1	1	...	31	.....

In 1891, 38 cases of animal "sui" poisoning were received from different parts of the province. Among these, 30 were such as showed punctures typical of needle poisoning, percentage of punctures observed being 78·94. The tongue was the organ which was chiefly punctured, *i.e.* in 22 cases. In three cases punctures were observed in the flesh, in three in vagina, in one in rectum, and in one in throat. In seven of the total number of cases received, poison was found, giving a percentage of 18·42, three times higher than the previous year. In two cases arsenic was found, in two ratti paste, in one croton paste, in one aconite, and in one red lead.

Year.	Total No. of cases of 'sui' poisoning in cattle referred for analysis.	Number of cases in which puncture was observed.	Position in which punctures were observed.						No. of cases in which puncture was not observed.	No. of cases in which poison was detected.	Nature of poisons detected.							Number of cases in which poison was not detected	Remarks.
			Tongue.	Flesh.	Skin.	Vagina.	Rectum.	Throat.			Arsenic.	Ratti paste	Ratti and Copper.	Croton paste.	Madar juice.	Aconite.	Capsicum and ratti paste.		
1892	15	6	5	...	...	1	...	...	9	8	8	...	...	...	...	...	......	7	......

In 1892, the total number of "sui" poisoning cases in cattle were 15. In six of them punctures typical of "sui" poisoning were seen, *i.e.*, 40 per cent. In five cases punctures were observed in tongue and in one in vagina. In eight cases out of 15, poison was detected, giving a percentage of 53·33. Arsenic was the poison which was chiefly used this year.

Year.	Total No. of cases of 'sui' poisoning in cattle referred for analysis.	Number of cases in which puncture was observed.	Tongue.	Flesh.	Skin.	Vagina.	Rectum.	Throat.	No. of cases in which puncture was not observed.	No. of cases in which poison was detected.	Arsenic.	Ratti paste	Ratti and Copper.	Croton paste.	Madar juice.	Aconite.	Capsicum and ratti paste.	Number of cases in which poison was not detected	Remarks.
1893	29	20	11	2	1	4	...	2	9	20	15	...	1	3	...	...	1	9	....

In 893, 29 cases of poisoning of cattle by means of "sui" were sent to the Punjab Chemical Examiner's Department for analysis. Out of these in 20, punctures indicating needle poisoning were visible, giving a percentage of 68·96. In 11 cases, the tongue presented punctures, in two flesh, in one skin, in four vagina, and in two throat.

Out of 29 cases submitted for analysis, in 20 poison was detected, furnishing a percentage of 68·96 of detections. In 15 cases, arsenic was found, in one ratti and copper, in three croton paste, and in one capsicum and ratti paste.

From the above statement, it appears that the poisoners generally puncture the tongue. In female animals they select the vagina for the purpose of making a puncture.

The retinal vessels, both veins and arteries, became well-defined and contracted, and the optic discs became distinctly pale ; the pupils remained widely and equally dilated and insensible to light. I made frequent and regular examinations, but my powers of observation did not avail to detect any very decided change in the ophthalmoscopic appearances during a period of quite three months. The general retinal ischæmia and disc pallor did indeed quickly become decided, and remained thus with no perceptible change for about six weeks, when a very slight improvement set in, but at the end of three months, the condition was much the same as previously described at the end of the first week, after the primary congestion passed off. During the fourth and fifth month a certain distinct but small improvement could be noted at considerable intervals, but when I left my charge for six months leave, the retinal anæmia was still the notable objective sign, the disc having fairly regained its normal tint. So far for the objective signs. As regards the subjective I may briefly add the follwing particulars :—

The absolute "stone blindness" lasted, I believe, for fully two weeks ; the first perception after that was the flash of light from the ophthalmoscopic mirror, but there was no perception of external objects until the third or fourth week, when certain things, a small bright metal timepiece, the looming figure of an individual, were seen at a distance of four to eight yards. This distant vision was a marked feature of the case for two or three months, and though it gradually gained in distinctness of outline and detail, was a blurred impression on a dim and hazy background. A noticeable point during the fourth week also was her perception at a distance of dark linear objects, *e.g.*, the parallel beams of the roof of the bungalow, and the cross bars of the windows in the doorways. Here also the definite objective points were lost in an indefinable haze. It was somewhat surprising that she could occasionally read the dial of the clock before mentioned, at four or five yards distance, but could distinguish no neighbouring object. Color blindness was marked from the first, but about the sixth week she noted the dark blue of my necktie ; red and yellow were, and are still, best distinguished. From the sixth to the eighth week onward, with occasional relapses, synchronous with a return of the menorrhagia, and other disturbances of the general health, she gained ground in all points very slowly but surely, and in April last she could write a letter and read large type,—the effort being exhausting to her visual faculty, and consequently not persevered in. At this stage I lost sight of the case owing to my departure on leave, but I have recently heard from my patient that, although much better in most respects, there is much left to be desired in her visual powers ; she gets about, reads and writes, uses her mirror satisfactorily for toilet purposes, but her color vision is defective, red and yellow being still most easily distinguished and these at a distance, nearness of approach causing objects to appear black ; the general hazy blur of the background of the visual field being also a trouble to her.

I would remark, in conclusion, on the likeness of the early symptoms to embolism or hæmorrhage into the disc, but this is of course contra-indicated by the bilateralism and the very considerable recovery, not to mention the absence of ophthalmoscopic evidence. Further, I think it will be allowed that in view of the evidence furnished by Laveran ("Paludisme") of the very general fatal effect of doses of quinine smaller than that consumed in this case, my patient has not paid a dear price for her life. The fact that she was frequently losing considerable quantities of blood by menorrhagia probably, I think, militated against her more speedy recovery, and the fact that she has since undergone the operation of curetting with satisfactory results would encourage the hope of ultimate recovery. I would assure anyone who has to treat a similar case of my sincerest sympathy ; it was certainly a great anxiety to me throughout, not perhaps more in the first days of deathlike collapse than in the long and weary weeks of waiting for light.

CERTAIN FACTS REGARDING THE POISON-LORE OF THE HINDUS.

BY N. SUBRAMHANYA AIYAR, M.A., M.B.C.M.

I. *Introduction.*—The object of this paper is to place before such a distinguished assembly as the one I have the honour of addressing to-day, certain facts regarding toxicology as understood by the early Hindus and as ascertainable from their writings. There does not appear to have been any systematic text-books of poisons written on the lines of modern European books on that subject, nor does the study of poisons, their symptoms, their diagnosis and their subsequent detection seem to have received any special attention. I propose to consider this subject under the following headings :—

II.—*Bibliography.*—The more important Sanskrit books dealing with the subject of poisons are the following :—

(1). *Ashtanga-hridya.*—A digest prepared by Vahatacharri from the great works of Charaka and Susrutha, who may be looked upon as the great apostles of Hindu medicine.

(2). *Hridaya-priya.*
(3). *Vishakrishneeya*, by Krishnachari.
(4). *Visha Chandrica.*
(5). *Rasa-valli.*
(6). *Kouthuka-chinthamani.*
(7). *Bhaishajya-rathnavali.*
(8). *Vishanarayaneeya*, by Narayanachari.
(9). *Vathsyayana-rahasya*, by Vathsyayanachari.
(10). *Rasa-rathnasamutchaya.*
(11). *Rasa-manjari.*

III.—*Puranic origin of visha or poison.*—Once upon a time *Devas* and *Asuras*, descendants of two sisters, churned the milk-sea with a view to get *amritha* or the sweet nectar of immortal bliss, as a result of which process several products are said to have been ushered into existence. The first product so evolved was a huge monstrous figure, which was considered the embodiment of evil, just as the nectar they were trying to get was the embodiment of good. This figure was looked upon as the incarnation of poison, and was, by the interposition of Brahma, destroyed and dissipated into a number of small particles, from which all the poisons of the world are said to have sprung. This account is taken from Astanga-hridaya.

Another account of the origin of poisons is mentioned in the book called Hridaya-priya ; but both these accounts have reference to the churning of the sea and the uprising of a terror-inspiring object, which disconcerted the minds of the Devas and the Asuras very seriously, and caused great grief or *vishada* (Sanskrit name of grief). Hence the term *visha* began to be applied, so it is said, to all substances having properties similar to the one that caused this primeval grief or vishadam.

IV.—*Classification and Enumeration of Poisons.*—Poisons are of two kinds :—

(*i.*) *Sthabara*—Immobile.
(*ii.*) *Jungama*—Mobile.

The sthabara poisons are those fixed to, or forming part of, the soil and includes—

A. Vegetable poisons.
B. Mineral poisons.

The jungama or mobile poisons are the animal poisons, of which snake venom is the most important. The Sanskrit books on poisons deal more largely with the latter class than with those that fall under the scope of the practical toxicologist. The study of these poisons, enshrouded as it is with elaborate accounts of *manthrams*, incantations, and detailed ceremonials, is too complicated and unwieldy to be touched upon in this paper. In this connection, it may interest you to know that, according to the Hindu books, tiger's tongue and waxy accumulation of the ear are poisons admitting of no antidotal remedy. But I shall, in this paper, confine myself to those substances which were recognised in the ancient Hindu books as poisons in the sense in which they are understood by modern European writers.

A. *Vegetable poisons.*—The following are the more important :—

1. The root of *Vatsa nabhi* (*Aconitum nepalensis*).—This is a rapidly acting poison.

2. The root of *Langali* (*Gloriosa superba*).—It is a powerful poison, and is said to have a special influence on the uterus. It is believed that if a parturient woman wears this root in contact with her body, delivery is accelerated. Antidote for poisoning—Ginger decoction.

The root, divested of its deleterious constituents and properly prepared, is reputed to be a great remedy for ascites.

3. The seeds of *Karaskara* (*Strychnos Nux Vomica*). Antidote—Jambul seeds (*Eugenia jambolanum*).

4. The root of *Aralu* (*Nerium oleander*). Antidote—Cocoanut milk.

5. The seeds of *Oodalam* or *Cerbera oodalum.* Antidote—Cocoanut milk.

6. The fruit of *Kaythaki* (*Pandanus odoratissimus*).—The fruit, if eaten, is said to kill some people and make others insane. Antidote—Whey administered at once.

7. The seed of *Thuravakam* (*Hydnocarpus inebrians*).—This substance produces death or insanity. The ashes of the root of this plant mixed up in an oily preparation is said to be an excellent remedy for rheumatism when applied locally. Antidote—The Kathali fruit (*Melastoma melabathicum*) and black pepper mixed together. The oil expressed from the seed is used for skin diseases.

8. The seeds and juice of *Bhallathakam* (*Semecarpus anacardium*) (marking nut). Antidote—Gentle aperients and ginger decoction with molasses.

9. The fruit and milky juice of *Kampilliakum* (*Tabernæmontana crispa*).—It produces acute irritation, excessive vomiting and violent purging. Antidote—Salt, whey and tamarind. A decoction of its root bark is said to be very efficacious in diarrhœa and dysentery.

10. The milky juice of *Snuki-euphorbia* (species).—It acts as an irritant and causes vomiting and purging. Antidote—Powdered gingelly seeds in molasses.

11. The fruit of *Thillakam* (*Citrullus colocynthus*).—It causes violent purging. Antidote—Powdered gingelly seeds in molasses. It is a good remedy in ascites.

12. The root of *Naga-danti* (*Croton polyandrum*) or *Jatropha glauca* (Drury).—It causes violent purging. It also acts as an ecbolic. Antidote—Decoction of *thrikatuku*, with a little asafœtida mixed in it. *Thrikatuku* includes the three acrid substances : ginger, round pepper and long pepper.

13. The seeds of *Neervalam* (*Croton tiglium*).—This substance taken in sufficient quantity causes death from excessive vomiting and purging. Antidote—Fresh lime-juice and butter milk.

14. The fruit of *Koashathaki* (*Bignonia scabrella*).—Tremendous vomiting, as if the bowels would come out, is said to be the symptom produced by this poison. Antidote—Dried ginger decoction and fresh ginger juice.

15. The root of *Brassica nigra* or *Sarshapa* (mustard) is said to be poisonous. Antidote—Butter or ghee.

16.—*Opium.*—The addition of oil to opium is said to increase its poisonous effects. Antidote—Fresh ginger juice alone, or mixed with fresh lime-juice and sweetened with a little sugar. It is mentioned as a great remedy for diabetes and colics of sorts.

17. The root of *Chithraka* (*Plumbago zeylanica*).—This is a virulent poison, and is said to produce sloughing of the bowels. Given to a pregnant woman, it produces immediate uterine action. Antidote—A confection of gingelly seeds in molasses.

18. The seeds of *Dhurdhoora* (*Datura fatuosum*).—This substance produces mental derangement and sometimes insanity when taken in sufficient quantity. The addition of any spirituous liquor is said to intensify its effect. Antidote—Expressed juice of onions and lotus flower.

19. The root and milky juice of *Arkka* (*Calotropis gigantea*).—This substance shews its effects on the brain, and is said to cause insanity in some cases. Antidote—Gingelly decoction. The root of this plant ground up

in milk is said to be an excellent remedy in leprosy and swellings of sorts.

20. The oil expressed from the fruit of *Ankolam* (*Alangium decapetalum*).—This oil is said to cause insanity and other grave mental disturbances. Antidote—The fruit of *Terminalia chebula* (*Hareetaki*). The root of this tree is said to be a good antidote for snake venom.

21. The leaves of Kalanja or *Cannabis indica.*—They cause when eaten great mental excitement. Antidote—Shower bath.

22. The hairs growing on the pod of *Atmagupta* (*Mucuna pruriens*).—They cause, if brought in contact with the body, a sense of burning and other symptoms of local irritation. Antidote—Local application of a pigment made of the Kathali fruit (*Melastoma malabaricum*) the leaves of *Ocymum Sanctum* and ghee.

23. The root of *Vacha* (*Acorus balamus*).—The root, taken internally, causes insanity. Antidote—Immediate administration of honey.

24. The root of *Vanasoorana* (*Arum gracile*).—This root causes itchiness of the body and general swelling. Antidote—Immediate administration of the expressed juice of the leaves of the tamarind.

B. The chief mineral poisons mentioned in Hindu books are :—

(1.) Cinnabar. (2.) Arsenic. (3.) Sulphur. There is nothing special mentioned under the above heads, as far as I have been able to make out.

There is another class of poisons called *garavisha.* These may be called compound poisons—substances which individually are quite innocuous, but when combined in a particular manner act as poisons, thus offering an analogy to chemical combination in that the result produced is different in properties from the materials that contributed towards the making up of that result. As examples of the above the following are mentioned :—

(1.) The flesh of a bird (vellipakshi) fried in oil derived from the fat of the pig. (2.) Long pepper fried in ghee, in which fish was once fried. (3.) Honey when warmed.

V.—*Object and Aims of Drugging.*—The purposes for which drugging is resorted to according to Hindu books, are the following :—

1. *Akarshana* or attraction, *i.e.*, to attract people and make them available for certain definite purposes.

2. *Sthambhana*, *i.e.*, to stupefy people and cause paralysis of all activity : physical, mental, and moral.

3. *Ootchatana*, *i.e.*, to work up the mind of a person as to make him run out of a particular locality, and even after dread the idea of returning to it.

4. *Mohana*, *i.e.*, to cause mental derangement in various ways and to different extents.

5. *Marana*, *i.e.*, to kill. This will include fœticide.

There are various books on Manthavada, which deal at great length on what is called Vasheekarana – a process by which one is enabled to bring another completely under his influence. It said that a *thilaka*, or mark on the forehead, with a preparation into which the root of the Madar (*Calotropis gigantea*), butter and honey enter, will give the wearer complete mastery over the universe. Several similar recipés are given, but it is needless to say anything more about them, as they are *primâ facie* absurd and unreliable. A native physician of some note told me the other day that he knows of a particular root which has the power of abstracting disease from a person by mere contact, and of transferring the disease to another person or tree by a similar contact. In certain kinds of fevers, he says, he has tried this process. The root is first tied to the body of the patient for an hour or so, and then tied to the branch of the *moringa* tree (*Moringa petrygosperma*), the patient at once begins to improve and the tree begins to die. He has promised to repeat them in my presence as soon as he gets hold of the particular root, which he says he has not been able to find for some time. This informant of mine is, to the best of my belief, not one that indulges in lies or even exaggerated statements. Hence the liberty I have taken of bringing it to your notice. I hope to take an early opportunity of trying the experiment, and I shall then publish the result. He learnt this from his Guru as an *upadesa* or inspiration, and is prohibited from publishing it, and there lies his safety.

VI. *Abortion.*—Certain curious methods are prescribed for inducing abortion, and I shall simply mention them :—(1.) Internal administration of the seed of the oleander prepared in butter. (2.) Exposing the uterus to the fumes of *Nimba panchaka*, *i.e.*, the five parts of the Neem tree : root, bark, leaf, flower and fruit. (3.) Saffron, red earth and cardamoms prepared in a special way and taken is said to cause abortion in four days. (4.) Rock-salt and oil-cake mixed together and taken internally. (5.) Gunpowder mixed up in a decoction of horse gram (*Dolichos uniflorus*).

VII.—Before I close I shall cite a few out of the many instances of poisoning from the Puranas and from folklore to shew that drugging and poisoning were not uncommon in ancient days.

(1.) In the Ramayana, it is said that Sagara Maharajah's mother when *enceinte* was poisoned by her fellow-queens, who were fired with envy and with a desire to cause their sister-queen's abortion. The poison did not take effect, and a healthy child was delivered in due course, and was called Sagara (*i.e.*, with *gara* or poison, implying that he was born *with* the poison). (2.) In the Mahabharatha, Durjodhona is said to have attempted to kill his cousin Bheemasana by poisoning. (3.) In the Mahabhagavath the son of King Chithrakethu was poisoned by his step-mother. (4.) Coming into more recent times we are told that when Tippu Sultan invaded Calicut, he sent for the Zamorin with the intention of making him a prisoner, and that through the occult influence of a *thilaka* or mark prepared by one Kulloor Nambooripad, a Malabar Brahmin of great fame in the matter of manthra vada, the mind of Tippu was entirely changed at the mere sight of the Rajah and his *thilaka.* This is a story handed down to us in Malabar, and I cannot vouch for its accuracy. I only mention it as forming part of the poison folklore of India.

VIII. *Conclusion.*—The scraps of information that I have now read to you regarding the poison-lore of the Hindus cannot have any practical value, but perhaps only an antiquarian interest. But Indian poisons deserve systematic study. Gentlemen who have had anything to do with chemico-legal work in this country will perhaps have observed that in certain cases coming before them, while the history may point to poisoning, while the physiological tests may suggest the same, it is not found possible for the chemical analyst to give the name of the poison used with any amount of definiteness, especially in the case of the vegetable poisons. Books on British Toxicology and the results achieved with reference to poisons recognized therein form at present the only *terra firma* on which the practical toxicologist feels able to stand; and as the poisons, mostly vegetable, used by the village quacks and herbalists and by professional poisoners do not fall under the scope of the above, the percentage of precise detections in cases of poisoning is ofter rather low. But before any substantive results in that direction can be obtained, an organization for the systematic investigation of Hindu medical science in general, and of Indian poisons in particular, will have to be set on foot. Thanks to the indefatigable exertions of some of the ardent workers in the field of Indian Pharmacography, we have in our possession an amount of valuable information, which, however, judged by the standard of perfection attained in other branches of scientific research, has to be considered still fragmentary. But it is earnestly to be hoped that the time would soon come, when, under the support and patronage of some of the distinguished princes and noblemen of India, a formal committee for the investigation of Hindu medical science will be started at a convenient centre in India, a museum of all indigenous drugs established under its auspices and a descriptive catalogue prepared thereof, an Oriental library of medicine instituted, research scholarships endowed and a journal started as the committee's organ, wherein its transactions may be published from time to time, the whole organization being equipped with the necessary working staff corresponding and co-operating with a number of affiliated branches at every important town in India. Such an arrangement will provide the necessary facilities for research for men who may have the requisite capacity and leisure. Isolated efforts, however diligent, cannot attain the success that co-operative exertions can alone secure. Indigenous drugs have begun to attract serious public attention, and the fact that at the biggest scientific assembly ever held in India, the subject of "Indigenous Drugs" has had the honor of having a section allotted to it, with two of the greatest native Indian workers, if not the greatest, as its joint president,—this, gentlemen, we should all welcome as an indication of one of the directions that Indian scientific research is destined to take in the near future.

ON FABRICATED INJURIES AND WOUNDS.

BY AKBUR KHAN, L. M. S.,
Demonstrator, Patna.

INJURIES are not unfrequently fabricated in India for the purpose of simulating an assault in support of a false charge, or with the object of concealing murder, robbery, or some other crime, and to avert suspicion. We cannot be too cautious in giving our decided opinion upon this intricate matter, as it is very difficult, nay sometimes almost impossible, to distinguish a genuine wound from a fabricated one.

These are made by different weapons, in different places, and in different ways; but they are made generally by some cutting weapon, and sometimes by some hard blunt one. Occasionally we find both genuine and fabricated injuries on the same person. This is generally done when the injured man supposes that the genuine wounds on his body are not sufficient for the cognisance of the police, or when they are not severe enough in nature. They are sometimes made longer and deeper than the original ones. I have seen many cases in which the genuine wounds were simply contused in nature ; but to make the case severe and of grievous hurt, fresh incised wounds were fabricated with weapons, which, in the eye of the law, are considered deadly.

The fabricated wounds are generally made, not on vital parts, nor so deep and serious as to endanger life. Parallel scratches are not infrequently made with some pointed substance to indicate that they are inflicted by an opponent's hands.

Attempts are sometimes made to simulate ecchymosis by applying the juice of marking-nuts (*Senecarpus anacardium*) or some other irritant substance such as chitta (*Plumbago zeylanicum*) to the skin. Such applications, however, usually produce blistering or a vesicular eruption, easily distinguished from ecchymosis. We must also bear in mind that in India severe, even mortal, injuries are sometimes inflicted on an individual with his consent by another person for the purpose of supporting a false charge.

The chief points in detecting fabricated wounds are—(1) the nature and situation of the injury ; (2) the direction of the wound ; (3) the number of wounds or injuries ; (4) the position and surroundings of the injured individual ; and (5) marks of blood on the body or on the clothing.

As regards the first point, *i. e.*, the nature and situation of these fabricated injuries. In case of incised wounds, if they are all "slight," the presumption is to a certain extent in favour of self-infliction ; but sometimes severe self-inflicted wounds tail off in mere superficial scratches.

As regards the second point, *i. e.*, the direction of the wound, it may be presumed that a fabricated wound has usually a particular direction, and almost all nearly parallel, when there are many in groups. But in these cases we must be very careful in observing whether the individual is right or left handed or both.

As regards the third point, *i. e.*, the number of wounds or injuries, when many slight wounds are present, self-infliction is generally, to a certain extent, contra-indicated. But there are people who would inflict upon their own person numerous wounds to avert suspicion or to support a false charge. Maniacs also inflict numbers of wounds on their bodies, but they do not impute the injuries to others. Great caution and care are therefore to be exercised in giving a decided opinion against self-infliction, simply because more than one wound is present on the body.

As regards the fourth and fifth points, *i. e.*, the position and surroundings of the injured person, etc., cuts or rents on the clothes, when they do not correspond in situation with the wounds on the body, may be supposed to have been fabricated for the purpose of supporting a false charge or removing suspicion. I have, during the last five or six years, seen four cases of this nature in which there was want of correspondence in situation between the cuts on the clothes and wounds on the body.

The nature and condition of the weapon found may also, to some extent, help us in distinguishing a genuine from a fabricated wound. Peculiarities in its shape, by their agreement with the shape of the wounds on the body, may indicate it to be the very weapon which is alleged to have been used. Particular marks again, indicating ownership, present on the weapon, may be important as evidence in favour of the guilt or innocence of the accused. Fabrications of other natures than those mentioned above are sometimes made by an individual even when in a hospital. With a view to make a slight wound a severe one, he applies to it some irritant substance to keep it fresh and to retard its healing up before twenty days, as prescribed by law. Sometimes he makes his slight wound longer and deeper by some weapon to give it an appearance of grievous hurt. In such cases sometimes both the ends of the wound tail off.

So the wounds that are self-inflicted are generally slight, and may consist of a series of small superficial ones. These are never found on vital parts, but always where there is little danger of doing much harm. These are generally directed from below upwards when in the lower part of the body, and from above downwards when in the upper part.

Contused fabricated wounds are very rare. I have seen only one case in which a woman made a scalp wound on her head by a *lorha*, a piece of rough blunt stone used in grinding spices. Great difficulty exists where life is destroyed by a contused wound voluntarily inflicted. Such self-inflicted contused wounds on the head by a blunt weapon may produce injury to the brain and cause death.

Regularity in direction in a wound is considered to be presumptive of self-infliction. Self-inflicted incised wounds are not often prolonged below and behind the skin forming the angles of the wounds deeply. They either pass transversely or obliquely from above downwards, and terminate gradually into a sharp angle.

Since I have joined the service, I have examined and observed hundreds of cases of injury, but nothing ever seemed to me more puzzling and trying than when I had to distinguish a fabricated wound from a genuine one and *vice versa*. As this is a question which simply on our evidence must prove a man's guilt or innocence, we therefore cannot be too cautious when we are required to give our opinion on the subject in a court of justice.

ON THE IDENTIFICATION OF EUROPEAN AND ORIENTAL SKELETONS.

BY R. H. CHARLES, M.D., F.R.C.S.,
Surgeon-Major, I. M. S.

SOME time ago I read a work entitled "The Memoirs of my Indian Career," by Sir George Campbell, a former Lieutenant-Governor of Bengal. The book, which is sometimes caustic, frequently satirical, and always forcibly egotistical, is an interesting one and will repay perusal. You will doubtless wonder what this has got to do with the subject of my paper. Well, the autobiography in question is the *fons et origo* of it, for in Chapter VI, pages 252-53 of Vol. I, Sir George, when describing an incident during the Mutiny period regarding the finding of a skeleton by the roadside, writes as follows about certain disciples of Æsculapius:—

"On 3rd October we marched to a place called Khoorjah, a considerable Mahomedan town, full of people who were, or had been, in our service, both civil and military. Though some of them had no doubt been in Delhi, and they had for a time received a rebel tehsildar, they had upon the whole not behaved badly, and now received our tehsildar and gave us a friendly reception, so I was anxious to treat them leniently. But then came an incident of which a good deal was heard. *Some one found a skeleton by the roadside, not a very uncommon thing in those days, and it was said to be the skeleton of a woman.* I believe some kind of medical committee was held upon it. I was not present, and cannot vouch for the story that went about the camp that of three medical officers *one* was very decided that *it was a woman*, *another* rather inclined to think *it was a man*, and the *third* very sagely pronounced that he could not exactly say, but of one thing he was quite sure, that it was *either a woman or a man.* However, the general verdict settled that it was a woman, and then it was evident that if it was a woman, it must have been *a large and large-boned woman.* From that the whole camp jumped to the positive conclusion that *it must be an European woman.* There was no pretext of any known case of any European woman who had been murdered in those parts, but people were not very logical in those days, and it went about that we had found the skeleton of a murdered European lady."

After reading this it struck me that there were two points to be determined here by the Board of Three :—

1st.—Was the skeleton that of a male or female?

2nd.—Was the skeleton that of an Oriental or European?

As to the first question. Even then most of the sexual differences in the skeleton were known, and the third member of the board, who from the canniness of his reply might have been a countryman of Sir George Campbell, should have been able to be more definite than—"it was either a woman or a man, though he could not exactly say!"

Question two is different. From my youth I have been in the habit of hearing that our more sombre colored fellowbeings, without their skins, could not be told from the whiter species. As much as to say the only racial and specific differences were those of varieties in color.

The specific differences I consider to be chromatic, osteological, and psychological. With the second only of these have we to do now, and I believe a knowledge of the points I am about to bring forward would have enabled Sir George Campbell's Board to speak more definitely, though it would perhaps have been of questionable service at the time had the skeleton been declared that of an European.

It is admitted that the identification of dead bodies is amongst the most difficult of the tasks falling within the province of the medical jurist. The determination of the race of a skeleton may also be acknowledged to be a matter of some perplexity. Taylor says, "it would be difficult, if not impossible, to pronounce an opinion of the race to which the skeleton belonged from a few detached bones or parts of bones."

Let us say, for instance, that an European soldier is missing—has disappeared from cantonments. Foul play is suspected. The police must find the criminal. Possibly then the inhabitants of some particular village may be charged with the soldier's murder by the perplexed guardians of the peace through the finding of a skeleton or a body in a state of absolute putridity in the neighbourhood of the abodes of the villagers. It is easy to procure a corpse in India, and, in case of a charge being made, either *bona fide* or with malice aforethought, one can imagine the medical officer on the examination of such a skeleton being able to report that the remains are those of a male or female, young or old; but being diffident in his opinion when asked whether they were of a European or Native of India. Should the missing soldier not be found the safety of the accused is certainly imperilled. Now, the danger in such a case of false accusation would be rendered futile, and the elucidation of a mystery facilitated, could the practitioner distinguish in a skeleton brought to him, not only the sex and probable age, but also the race. Being impressed with the necessity of medical men in India possessing the foregoing discriminative power I bring the subject before you.

Rules for the determination of the sex, age, stature and period that has probably elapsed since the death of the deceased are already sufficiently explicit and are tabulated in the usual text-books on medical jurisprudence. But when this information has been satisfactorily arrived at, there still remains to be stated the answer to the enquiry: Is the skeleton that of an European or Asiatic? Before alluding to the points enabling one to answer this question unhesitatingly, I shall preface my remarks with an explanation of the presence of the verifying markings on the skeleton of an Oriental.

The peculiarities in the vertebral column, pelvis and lower extremity of the Eastern male or female to which I am about to draw your attention are due to the changes brought about in the bones by the habits of sitting in the squatting and sartorial position, *i.e.*, to the non-use of the chair as amongst Western races.

The increased use of certain parts of the skeleton induced changes in form, size and structure. From generation to generation small differences have been accumulated in the evolution of the Oriental races, so that an acquisition has become a permanent possession. These particularities in their osteology are decidedly beneficial and "suitable to the individual under its conditions of life," and they render function of easier and better performance, as witness the manner in which the Asiatic can rest in either the sartorial or squatting postures as compared to the agony undergone by the European after the adoption of like positions for any time.

The practical bearing of the presence of these morphological peculiarities to the medical jurist is that *by them he can differentiate the Oriental skeleton from the Europeans.*

Let us take first the lumbar and sacral vertebræ keeping in mind the ordinary distinguishing characters of the Western type, and we shall find differences from that standard.

As a rule the *body* of a Panjabi lumbar vertebra is *thicker behind than in front*—the base of the wedge (thickest part of the centrum) being turned backwards; and as the type matures with age the excess of the posterior diameter over the anterior becomes more pronounced. In the female only is the anterior measurement greater than the posterior. The total posterior diameter of the five lumbar vertebræ I have found exceeded the anterior by 19 mm in one case. Generally the difference is 8 mm in favor of *the posterior.* Amongst European skeletons Sir William Turner states there is a variance of 5·6 mm in favor of *the anterior surface.*

The 5th lumbar vertebra is only exceptionally wedge-shaped as in the European.

Up to the age of 12 years none of the typical changes have taken place, and it is probable that they occur in the epiphysial area, and that it progresses from puberty to 25 years of age, eventuating in the fact that the *deepest part of the centrum of a lumbar vertebra is behind and not as in the European in front.*

The LUMBAR CURVE is straight or very slightly convex. The mean general lumbar index of some recent vertebral columns I found to be 106·8. Sir Wm. Turner quotes 96 as the index for European lumbar curves.

The accessory processes of the 5TH LUMBAR are frequently very largely developed and often articulate with the alæ of the sacrum.

The *auricular surface* of the SACRUM I found in 78·7 per cent. to be formed of only two vertebræ; the first and second European sacra have this surface formed from three vertebræ according to Professor Macalister.

The peculiarities mentioned are more difficult for the ordinary practitioner to determine than the following :—

The ACETABULUM.—The most distinctive differences in the morphology of the acetabulum of a native of India are to be found—

First, and principally, in the great size of the *ischial portion* of the *facies lunata.* The rim of the acetabulum here is very prominent—the groove for the obturator externus below it is consequently deep.

Second, in the extension forwards and widening out of the *lower horn of the facies lunata*, whereby the cotyloid notch is, as it were, partly bridged over, instead of being an irregular open space. It looks as if the transverse ligament were ossified on its ischial side.

Third, the *cotyloid notch*, which in the European os innominatum is, as a rule, open, presents in all well marked Indian bones the characteristic of being arched over by the forward and upward prolongation of the inferior cornu of the facies lunata. The superficial boundary of the cotyloid notch in the European consists of the transverse ligament alone; the same boundary in the Indian consists of bone (part of the ischium) plus the transverse ligament.

The head of the FEMUR.—The articular area is of greater extent relatively and absolutely than that of an European bone. The surface is specially prolonged to adapt itself to the modified facies lunata of the acetabulum during extreme flexion and partial abduction, and during semi-flexion and extreme abduction occurring in the hip-joint in the squatting and sartorial postures.

The *neck of the* FEMUR is longer relatively than in the European.

The *upper* surface of the *internal condyle* of the FEMUR is partly articular. This is not so in the European, where it is merely rough for the internal head of the gastrocnemius. It is due to the power of extreme flexion possessed by the Oriental knee-joint.

The *head* of the TIBIA is set on the shaft very obliquely. An Oriental tibia can be easily held by the finger and thumb when the internal tuberosity is grasped behind by them.

The *upper surface* of the *internal tuberosity* slopes considerably down and in; it is never flat as in the European bone.

The *external tuberosity* of the tibia has its condylar surface convex from before back and the articular area is well prolonged down posteriorly.

The upper part of the tibial diaphysis is commonly directed obliquely backwards.

On the *anterior margin of lower extremity of the tibia*, a facet will in the great majority of cases be found on what is the ligamentous area of the European bone.

In upwards of 17 per cent. of tibiæ a second facet on the same border, but occupying a more internal position, will be seen. Both these articulate with corresponding articular areas on the upper surface of the neck of the astragalus.

The ASTRAGALUS contrasted with the European differs considerably. There is a facet on the *upper surface* of the neck to the outside; there is a facet on the same surface more internally, which is continuous posteriorly with the trochlea and internally with the pyriform malleolar articular area. The pyriform articular area on the *inner surface* is greatly prolonged forwards, at times encroaching even upon the neck; when so, it is concave from before back. The outer facet alone may be present. The inner facet alone may be present. There may be merely the greatly elongated pyriform facet as a distinctive character.

The *outer margin* of the neck is much thinner than in the European bone—markedly so. On the head there is a greater prolongation of the articular surface both internally and externally, relatively to the size of the bone, than in the European specimen.

The under surface.—In the European bone the deep concavity for articulation with the large convex facet on the upper surface of the os calcis is bounded generally by two sharp non-articular margins. In Oriental bones the outer margin is frequently articular on its inferior aspect as this part, when the facet exists, articulates with the upper surface of the greater process of the os calcis.

The Os CALCIS.—The *upper surface of the great process* amongst Europeans is generally rough for ligaments and for the attachment of the Ext. Brev. Dig., whereas often amongst Orientals there is a facet continuous with the large posterior articular surface on the body of the bone. This facet is for the lower extremity of the outer margin of the astragalus to which I have just now referred.

Anterior surface of the great process.—There is as a rule but a very narrow rough margin between the saddle shaped surface and the articular facet on the upper part of the sustentaculum tali as the concavo-convex surface is largely prolonged up and in. In European bones there is a less prolongation and a larger rough margin.

Eventually I hope that much information furthering the object of this paper will be furnished from an examination of the skull, but at present the data are not sufficiently extensive to speak authoritatively. I trust though that soon it will be possible to differentiate the skull of a native of India from that of an European, as well as to tell his probable caste from the racial point of view. For practical purposes it may be assumed that most male Indian skulls, certainly those of the lower castes, have a cubic capacity of 1,360 c. cs. or under, whereas European male skulls run from 1,500 c. cs. and upwards. The measurement of the cranial cubic capacity is easily taken with mustard seed, which is procurable in any bazar.

Some points commonly assigned by authorities as differentiating European and Asiatic skeletons are to be used with caution.

1*st.*—The bones of the Oriental are smaller. It is generally so, but not by any means always, as witness the skeleton I now show you, which is that of a Panjabi. It measures 6′ 1¼″.

You also notice that the bones are large and well marked.

2nd.—The skeleton of the Oriental is lighter.

An adult male European skeleton weighs about 10lbs. 6oz., the female weighing 8lbs. 13oz.

The skeleton of the Panjabi just mentioned weighs 12lbs. 3oz.

This is however exceptional. The rule holds truer for female skeletons. Here is one of a Panjabi female which weighs 6lbs. 2oz. There is a greater difference in weight and stature between the Indian female and the European female than there is between the males of these races.

RELATIONSHIP OF CRIME TO INSANITY AND HEAD MEASUREMENT WITH SPECIAL REFERENCE TO CRIMINAL RESPONSIBILITY.

BY R. J. MACNAMARA,
Surgn.-Captain, I. M. S.

PERHAPS no subject of equal importance has received less attention than that of the connection of crime with insanity. It is one of great interest to the general public as well as to the medical profession, whose duty it so often becomes to decide the question of sanity or insanity in criminal cases. The law judges the responsibility of persons by their knowledge of right and wrong without any reference to other mental defects, so it may happen that a man ordinarily regarded as insane is held accountable for his actions. As a matter of fact, the plea of irresponsibility is seldom put forward except in extreme cases, and that of diminished responsibility from deficiency of self-will is never heard of in mitigation of an offence.

The law of England as to what constitutes insanity and irresponsibility remains to-day as it was laid down 50 years ago by the judges, who, in reply to a series of questions put them by the House of Lords, ruled that to entitle an accused person to an acquittal on the ground of insanity, it must be shown that at the time he committed the act he was not conscious of right or wrong, or was under a delusion which made him regard the act as right. This is the legal view, but from the medical standpoint it is far from satisfactory, because it is now a tolerably well-known fact that a man may have so little self-control as to be totally unable to restrain himself from committing an offence he knew to be wrong; in which case he would be legally responsible, though medically irresponsible. As long as the law holds a man accountable for an act which it was not in his power to prevent, so long will it need amendment.

The important point to aim at is the administration of the law in such a way as to prevent persons being punished for actions which are wrong, and which they know at the time of commission to be wrong, but which are the result of pathological processes over which they had no control; and in the case of persons with diminished power of self-restraint, adjusting the punishment according to the degree of culpability.

For the ends of justice, it is of course of the utmost importance not to adopt a principle which makes slight mental infirmity incompatible with responsibility in some form.

At the present time punishment legally administered is in proportion to the injury done. If a man knocks a tooth out of another, he has committed grievous hurt, with a severe penalty attaching thereto, whereas the same force applied to an adjacent part becomes only a trifling hurt, with a correspondingly light punishment. It is clear that the culpability attaching to both injuries is the same, and that if power of self-will, so much advocated by medical jurists, were used as the standard to measure responsibility by, the ends of justice would be better served. The difficulty is, how could this power of self-will be measured with tolerable accuracy and the principle applied? Beyond the circumstances of the particular case under investigation, and the life-history of the accused person, there would seem to be no other means by which to test his self-will, and a correct life history is not always easily obtained, so that in many cases there would be little or nothing to go on but the nature of the offence itself.

The law recognizes what is known as "malice aforethought" in certain crimes, and this is as it should be, because a man who has self-will enough to restrain himself from committing an offence on the spur of the moment materially adds to his culpability by committing it after due consideration. This "malice aforethought," however, is applied to only a small number of cases, and does not alter the fact that self-will and individual peculiarity are not usually taken into account when punishment is administered, from which it follows, almost as a matter of course, that, amongst a body of convicted prisoners, there will be found a less control over the will than amongst the same class of men outside.

Injury to a fellow-man in person or property is the great cause of imprisonment. Whether a man commits a crime under one or other heading, the point to ascertain is—was it in his power to prevent it or not. If not, he lacks self-will, is mentally defective and blameless for his action, but if he possesses self-will and fails to use it, he deserves punishment. If the case be one of assault, the perpetrator, with motive and knowledge of the penalty attaching to his action, commits himself and readily accepts a term of imprisonment in return for an injury inflicted on an opponent. He is the real criminal. Again, the thief with self-will steals with motive and knowledge of the penalty he incurs, simply because it is much easier to appropriate his neighbours' money or goods than earn his living by honest means. Here, again, we have the real criminal. If he succeeds in his plans, he gains his point and purchases ease and luxury at his neighbour's expense, whereas if he fails, he, at all events, is assured of a sufficiency of food, etc., in jail, and his skill and energy are not too severely taxed, as they might be if market prices are high and work difficult to get. As soon as criminal investigation reaches that point, when few crimes escape detection, and life in prison is made more a punishment than it is, so soon will preventible crime begin to dwindle, and in our jails will be mostly found the prisoner of the ignorant and imbecile class—those who are deficient in self-will and whom no punishment can wean from their criminal habits.

It is stated to be a fact that the number of thieves in jail bears a fairly constant ratio to the cost of living. This shows that many are driven to theft, who, if they could earn a sufficiency to live on, with a moderate expenditure of energy, would do so, but when prices rise high, the limit is passed and theft increases. The rise in prices will not affect the skilled and energetic workman much, as he can always earn more than sufficient for his daily needs, and will not barter his liberty by committing theft, setting aside altogether the moral aspects of the case.

Those who are driven to extremes, whether through mental deficiency, want of skill and energy, and those possessed of a limited amount of self-control, are the classes who sooner or later find their way into jail; and these considerations led me to investigate the subject further by taking criminal head-measurements, and comparing them with those of more law-abiding citizens. Before, however, touching on the subject of heads, it would perhaps be well to trace some of the points of resemblance between the criminal and lunatic. I have already given, as the two great causes of imprisonment, injury to person and to property, and amongst the insane we recognize these in the homicidal maniac, and kleptomaniac who differ from the criminal only, by the complete absence of motive and self-control. The difference is, however, very often only a matter of degree. The offender against the person has generally a motive and an incomplete command of his self-will. He is recognised as the irritable and excitable man who at ordinary times conducts himself well, but on slight provocation is liable to lose control over himself. Sympathetically handled, he gives but little trouble. Given an easy means of seeking justice, in the shape of an attentive ear, and enquiry into his grievances, he can very considerably be weaned from his failing of taking the law into his own hands.

Assaults by prisoners in jail are occasionally committed without any provocation to test their self-control, and in these cases the object in view is often a desire to be transferred to another jail, as this procedure is sometimes followed when a prisoner commits a serious offence; or a desire to establish a name for himself amongst the prison staff that they might be induced to deal leniently with him.

The thief who most resembles the kleptomaniac, and by no means a very uncommon variety, is the man who, endowed with a certain amount of self-will, is born with a thieving propensity, and who, if not supplied with all the necessaries of life, can but very badly combat the desire of laying his hands on anything worth stealing, which may be placed in his way. That low types of humanity are common in jails might I think be surmised, judging from the writings of those who have devoted much time to the study of insanity. Gorget, a famous writer, describes certain classes of imbeciles thus: "They steal adroitly, and hence are considered very intelligent; they recommence their offences the moment they are released, and are believed to be obstinately perverse." And again: "These beings of limited capacity furnish to prisons and scaffolds more subjects than is generally supposed." Such words are not alone true of imbeciles, but describe to a nicety a large number of prisoners in our jails, into which, as Gorget remarks, many imbeciles find their way, whose low cunning is mistaken for intelligence, and inability to alter their thieving propensities, as obstinacy and perverseness. Another writer says about imbeciles: "They follow occupations requiring little sense or skill, are liable to fits of ungovernable passion, are lazy, addicted to theft, and ultimately become inmates of jails, workhouses, and lunatic asylums. From these remarks it can be little cause for surprise to find amongst a lot of prisoners a certain proportion who approach very closely to the imbecile class." And the connection is still further borne out by—

First.—The large number of prisoners whom it is necessary to transfer from time to time to lunatic asylums, as compared with non-criminal lunatics, and even this number is but a small proportion of those who might be classed as weak-minded, but who are harmless enough to be detained in jail without risk.

Second.—Epilepsy, which is so frequent amongst certain classes of lunatics, is in frequency in jails out of all proportion to what it is amongst the free population.

Third.—Bluntness of the senses generally as exemplified by the apparent want of feeling when small operations are done, or corporal punishment inflicted.

Fourth.—Tendency to untidiness, want of a feeling of shame in exposing themselves, morbid appetite, and inclination to filthy habits—all in their way regarded as signs of unsoundness of mind—are inordinately common amongst criminals.

Fifth.—The want of purpose often displayed by criminals in committing offences inside the jail is sometimes very marked.

With mental defect so common amongst prisoners, the supposition does not seem unreasonable that their brains may be deficient in some way, as it is generally admitted that increased brain weight carries with it increased mental power, and the bigger the brain the more intelligent the man, and the better developed are all his brain functions. Cuvier had a brain weighing 64 ounces, whereas the brain of an idiot seldom weighs more than 25 ounces. Here we have an enormous range between high mental development and idiocy, and the great bulk of mankind fall between the two. As I shall endeavour to show, the criminal head ranks low in the scale, if exterior head measurement may be taken as indicating the size of the brain.

Mental development may take a particular direction instead of being equally distributed amongst all the faculties. The development is dependent on training on the one hand, and the crude brain material set aside for any particular purpose on the other. Where the best training is brought to bear on the best material the greatest perfection may be expected. Like other functions, that of self-will may be poorly developed and as the result of training, may be much improved. If it be markedly inferior, and when it is, other functions are apt to be of an inferior order too, owing to the want of the controlling power of the will, a diminution in the size of the brain and head may be looked for.

The measurement of sixty criminal heads was taken with the intention of comparing them with the brain weight in case of death, and to see how far one is justified in forming an opinion as to the size of the brain from exterior measurements. As it happens, none of these criminals have died, so that my enquiry so far has been restricted to head measurement only. It need hardly be said that in any individual cases the size of the head gives no exact indication of the quantity of brains it contains, calculations being so liable to disturbance from various causes such as quantity of hair, thickness of integument and skull, and prominence of frontal sinuses. Hydrocephalus in childhood is a frequent cause of enlargement of the head in which the brain does not share, and an insuperable difficulty is the impossibility of measuring the depth of the cranial cavity. However, when comparing one series of head measurements with another, these errors disappear, as they are as liable to occur in one set as the other, and the greater the number of heads examined the more correct the comparison becomes.

Though the difficulty of arriving at a conclusion as to the size of any particular brain when the head is large may be very great, the same objection cannot exist when the head is small, because a large head may contain either a large or a small brain, but a small head must contain a small brain. If therefore a head is so small as to be incapable of containing a fully sized brain it seems a reasonable conclusion that its possessor is deficient in mental powers. If it be admitted that brain weight is in direct proportion to the mental powers, and the size of the head bears a fairly constant relation to its capacity (with of course exceptions), it follows that in comparing one lot of heads with another, we are justified in concluding that, if in one series the measurements are smaller than in the other, so also will the mental development be proportionately small. The principle however can only be applied generally, and not for the reasons stated to particular cases.

For measuring purposes Bertillon's sliding rule and callipers were obtained, and the only qualification used in the selection of criminals was that three previous convictions had been recorded in each instance.

In this way the most pronounced class of criminals would come under observation.

On the other hand, for the comparative experiment, an equal number of outsiders were taken. All the latter were policemen or members of the jail staff. I do not think that race or caste could be the cause of any difference between the two sets of observations, as the men in both parties were Sikhs, Mahomedans or Hindus, as they happened to present themselves, and all were more or less from every district in the Punjab. It may be said that the comparison between a number of policemen and an equal number for criminals is unfair, owing to the former having to pass a physical examination before admission to the force.

Head measurement, however, forms no part of the examination, and it has not yet been shown that it bears any relation to physique for which the men are selected. The following table shows the result of the sixty habitual criminals and sixty outsiders whose heads were examined :—

Measurement.	Non-Convict.	Convict.	Difference in favour of non-Convict.
	CM. M. M.	CM. M. M.	
Average length of head ..	19·3·61	19·2·15	1·46 M. M.
Average breadth of head ..	14·7·07	14·5·36	1·71 M. M.
Longest head	20·6	20·9	———
Shortest head	18·0	17·6	4 M. M.
Broadest head	16·1	15·9	2 M. M.
Narrowest head	13·5	13·3	2 M. M.
Heads 19 C. M. or more long.	40	35	5
Head 15 C. M. or more broad.	45	38	7

From this table it will be seen that the non-criminal head has the advantage in every instance in which an average is struck, or a number of heads taken into the calculation, and in regard to individual measurements, in only one instance, *viz.*, maximum length, does the criminal head exceed that of the non-criminal. This latter is of little importance, as it fails to give the leading place to the average length of the criminal head when such a large number as sixty is calculated.

The difference between the average lengths and average breadths will be seen to be very small, and in any individual case would doubtless be of little import, but when taken over a large range of heads, its importance becomes apparent.

For the purpose of comparing two heads when in one, the antero-posterior diameter is in excess, and in the other the transverse I multiply both diameters. This product will not of course give the sectional area, but it gives with fair accuracy a means of comparing one sectional area with another, thus :—

Average length by average breadth, non-convict's head	284·83
Average length by average breadth, convict's head	279·59

so that the sectional area of the average convict's head is to that of the average non-convict's head as 279·59 is to 284·83, or nearly as 53 is to 54, or in other words, if sectional area alone is taken as the guide to the quantity of brains in the skull 53 non-convicts will possess as large brains as 54 convicts. Allowing the brain to be about 50 ounces, this will give each convict on an average one ounce less brain than his more fortunate neighbour outside.

This is doubtless much below the mark, because there is every reason to believe that the average depth of the cranial cavity would, in convicts, be found to be less than in non-convicts, as actual measurement in the case of the exteri-posterior and transverse diameters has been found to be ; so that one ounce of brain very inadequately represents in all probability the difference between the convict and non-convict's head. If 1·5 millimetres be allowed to represent the difference in depth of the cranial cavity, and this is not more than is warranted by the other measurements, the difference in the weight of brains exceeds one and a half ounces.

To sum up. The observations so far recorded go to show that—

(1)—Criminals as ordinarily met with are as a rule defective in mental powers as compared with the classes from which they are taken, and that this is borne out, not alone by every-day observation of their habits, manners and mode of life, but by cranial measurement, and the fact that jails are fruitful recruiting-fields for lunatic asylums.

(2)—That the law of responsibility for crime is too hard and fast ; that it should be more liberal in its scope, and more attention paid to the mental condition of accused persons, so that those with slight mental derangement might be held partially and not completely responsible for their actions.

(3)—That the power of self-will, so far as it is possible to apply it, should be used as the means to measure punishment by, rather than the extent of the injury done.

(4)—That, considering the mental state of a number of confirmed criminals, great care should be exercised in making due allowance for their incapacity, avoiding at the same time undue leniency which might be mistaken for condonation of their acts, or an encouragement to commit themselves again. The fact of a heavy punishment acting as a deterrent to crime is the best proof that a man is possessed cf sufficient self-will to control himself, and where self-will is wanting, no punishment will have effect.

Already I am afraid I have exceeded the time allotted for the reading of a paper, but the importance of the subject must be my apology. If I may express a hope, it is that something may eventually be done to bring the law more into accord with medical opinion on the treatment and responsibility of criminals and accused persons.

SECTION

OF

PHARMACOLOGY AND INDIAN DRUGS.

FIRST PRESIDENTIAL ADDRESS.

BY GEORGE WATT, M.B., C.M., F.L.S., C.I.E.

GENTLEMEN,—When the Central Committtee did me the honour to invite me to become one of the Presidents of this Congress, I confess it was with a feeling of considerable diffidence that I accepted that position. Though I have been engaged in this country on scientific investigations during the past twenty years, I have not practised the profession of medicine. I therefore hesitated whether or not I could lay before you facts of personal experience that were likely to prove of value. My duties as Reporter on Economic Products to the Government of India require me, however, to investigate the sources of supply of the articles of Indian trade, and naturally I am brought, among other kindred subjects, into contact with questions connected with indigenous drugs. I trust my distinguished colleague, Rai Bahadur Kanny Loll Dey, C.I.E., may not regard me as trespassing, however, into the domain with which his name has been honourably associated for so many years, when I propose to direct your attention to certain matters connected with the indigenous drugs of India.

In placing before you a few personal observations and results of certain investigations in connection with the indigenous drugs, I desire you to understand that I purposely leave untouched two lines of enquiry, *viz.*, the Classic and the Therapeutic. Indeed, I venture to think that we have lost much time and many valuable opportunities, through the energies of the distinguished investigators who have adorned the century that is now rapidly drawing to a close, having been disproportionately directed to solving the mystery of the classically-famed drugs, the names of which have come to us through a vista of ages and dynasties since the Sanskrit-speaking race first invaded and peopled the Peninsula of Hindustan. I am fully aware that there are questions of great importance and interest intimately associated with the solution of such historic problems, but these have little more than a passing bearing on the Science of Medicine. Were we to add a new economic product to our list of useful plants, by solving the mystery of the *Soma*, then the position would be entirely different to that which I desire to recommend to your consideration. But the fact that we are now unable to recognize the much-famed *Soma* might, indeed, be held as showing that either its properties had been purely supposititious, or that the plant had disappeared from the world, the controversy that it is very possibly this plant or that, since each theory can be supported by circumstances laboriously and cleverly worked out, may be instructive and may tend to elucidate obscure points of language, ethnology or history ; but how much of the controversy can be held as advancing the science of pharmacology ?

So, again, the transference of names from one object to another may be said to be an all too frequently inherent consequence of the progression of the human mind. It can be demonstrated as having taken place, and as taking place now, in every field of thought, with the result that the *Soma lata* of the present day need have little more than a superficial resemblance to the ancient article; if, indeed, the modern usage of that name be anything more than a pure coincidence. To give a place in our pharmacopœia to drugs, because of probabilities and coincidences of the nature indicated, would obviously be unwise. We may be interested in speculations, such as that indulged in by Dr. Wise, in his two-volumed work entitled "A Review of the History of Medicine," but how much do we advance the healing art of to-day by demonstrating that the knowledge of disease and its treatment came originally to India from Arabia, or was dispersed in the opposite direction? While not, however, desiring to minimise, or to speak disparagingly even, of the value of such philosophical and philological investigations, it seems to me that we would do well to call for greater attention being given in the future to the medical knowledge that actually exists and is practised in India at the present time. Ever since the British Government established its administration in this great Empire, Western thought and Western science has been undermining, and one might almost say, sapping the life out of the hereditary arts and sciences of this country. The British may, in fact, be viewed as having come to India as the pioneers of a new civilization—a civilization that has much to recommend it. In their enthusiasm they have occasionally, however, been carried beyond the true position of reformers in that they have here and there been guilty of the neglect to recognize the principles that gave vitality to a civilization that had stood the test of centuries. We have as it were been stooping to the reformed, instead of raising to the level of the reformer. We have studiously imparted the little that could be absorbed, instead of developing the much that was of value, and that wanted but the helping hand of evolution and adaptation to be, indeed, of equal value with exotic conceptions and means.

The effect of all this has not unnaturally come about that much is being lost that with great advantage might be preserved. A child-like dependence is rapidly taking the place of self-help, which in no department is more to be deplored than in that of the knowledge of indigenous drugs. As it seems to me, therefore, we must bestir ourselves if we do not wish to see India lose very materially the knowledge which she possesses—a knowledge probably she might in many directions beneficially impart to the rest of the world. This danger, Gentlemen, I trust you will agree with me, is undoubtedly great, when the subjects of enquiry that have filled the minds of the few who have turned their attention to the indigenous drugs have been very largely historic and philologic investigations. The absorbing theme, under these conditions, becomes the past, not the present knowledge. In consequence one might be prepared to make what would, of course, be regarded as a useless challenge, *viz.*, that given a few months' study in any one province, a catalogue of the indigenous drugs in daily use by the people could be prepared, which would contain twice as many articles of that nature to that enumerated in any similar work already in existence. I make this statement, Gentlemen, advisedly, because my object is to impress upon you that there is a rich field for exploration in the drugs actually in demand by the people of India, more especially the drugs in use by distant village communities and aboriginal tribes. In illustration of this view I shall endeavour to lay before you a few of the results of a rapid tour which I have only just completed through certain districts of the Punjab and the Central Provinces. But I do not single these out as very specially deserving of your consideration, but rather as showing the impossibility that exists of throwing oneself among the rural communities of India without learning from them something of interest.

These remarks, therefore, lead me to the second subject of investigation, which, as a rule, I do not pursue, and upon which, therefore, I am unqualified to give an opinion, *viz.*, the determination of the therapeutic actions or value of indigenous drugs. Not being personally engaged in practice, my studies consist very largely in discovering the botanical, zoological, or geological sources of products, to record their vernacular names and reputed properties. In course of time such observations begin, however, even in my diary of records, to assume importance. It is scarcely conceivable, for example, that an almost universally-prevalent plant, such as *Adhatoda vasica*, could have come to possess indigenous names, in almost every language of this country (names that imply little or no intercommunication of ideas), while, at the same time, the attributes of the plant should be the same from Cape Comorin to Afghanistan, unless we are to attach considerable importance to the reputed properties of the plant. It is no such observations that I venture from time to time to recommend new or little known drugs to the consideration of the profession, and it is on similar lines of reasoning, Gentlemen, that I would urge you to separate the wheat from the chaff of village herbalism. It is somewhat curious that, with the indigenous as with the European drugs, we can very nearly come to speak of at least two great classes of dealers. These are the owners of regular drug shops, but on market days and at fairs, certain traders very commonly spread out pieces of cloth on the roadsides and arrange all over these little piles of roots, barks, fruits or flowers. Such dealers may be regarded as the herbalist of India. In the Central Provinces the people of this class are, for the most part, Gonds, but every district has its peculiar traders in locally-collected drugs ; and, speaking generally, these drugs possess greater novelty than the contents of the bags and baskets which are piled one above the other around the ordinary village drug-seller, who, frequently, combines the trade of grocer with that of chemist.

By way of illustrating a herbalist store I have placed on the table for your inspection a set of samples procured in Nagpur. These were purchased by a native gentleman, who was instructed to go to the weekly market of that town, and secure a complete set of the articles offered for sale by any one trader. I have not attempted to name these as yet, but shall be glad if you Gentlemen, will do me the honour to determine the botanical sources of this very small collection. By doing so, I venture to think you will realize the full force of my contention that even the best informed among us are remarkably ignorant regarding the drugs of the domestic life of the people of India.

With these observations I may, therefore, dismiss the subject of the Indian herbalist, and with your permission shall place before you a very few examples of drugs procured by me personally, either in the jungles or from the village drug stores, during a tour in the Kangra District of the Punjab, which lasted for a few weeks.

1. *Rhubarb* (*Rheum emodi*) *Chukri.*—In the village of Baijnath, Kangra, the traders with whom I conversed informed me that they annually exported about 1,000 maunds of this root to the plains. In taste the crude root is bitter, very woody, and has little of the characteristic smell of the imported drug. It is said to be used as a purgative, but more particularly as an ingredient in certain preparations applied to wounds and for ophthalmia.

The use of Indian rhubarb as an external remedy does not appear to have been mentioned previously, but while I am not prepared at present to recommend its being experimented with in that direction, I venture to think that a trade of the magnitude I have indicated is far in excess of the total previously recorded for all India, and the figure I have mentioned was given to me by several independent persons, and was subsequently confirmed at Palampur, Kangra City, and other localities. The total exports from Kulu and Kangra must, therefore, be very considerable.

2. *Karu* (*Picrorhiza Kurrooa*).—Although considerable confusion exists in the writings of many authors regarding this root, and a series of articles have been more or less collectively designated *kutki*, there is no doubt of the fact that *karu* is both a popular and valuable drug. It is, in small doses, said to be a bitter stomachic, useful in dyspepsia ; in larger doses antiperiodic, while possessing in addition a useful purgative action.

The plant is very prevalent throughout the Himalaya, at altitudes of 10,000 to 15,000 feet. Its collection and transportation gives employment to a large number of persons. In Kangra alone, during a march of about a week's duration, I must have seen quite 100 mule loads of this drug being carried toward the plains. In many respects, this drug is superior to the gentian imported by India, and used in European pharmacy.

3. *Gentiana Kurrooa.*—This is one ofthe plants confused with and said to be sold along with the true *karu* or *kutki*. In Kulu Valley, from Manglaur to Sultanpur, it is very prevalent, growing among the grass. It was in full flower in October, but although I asked nearly every person with whom I came in contact, I could never learn that it was put to any use, and certainly never heard it receive the name of *karu*. There seems, however, no doubt of the fact that this very prevalent and beautiful plant could be supplied in

large quantity, should a demand arise for it, as a substitute for the official gentian.

4. *Actæa spicata.*—This might be procured in very large quantities from the higher ranges of the Western Himalaya. Although I showed the plant to several drug collectors, they knew nothing of its uses, nor could give me any vernacular name for it. They informed me its chief use was as an adulterant for the very expensive drug (said to be imported from Tibet) which is known as *mumira* (*Coptis Teeta*). The roots are scarcely distinguishable externally from those of podophyllum.

5. *Mumiai* is sold in all the drug shops of Kangra. It is imported from Lahaul and Tibet, and finds its way from Kangra all over India. I need scarcely remind you, Gentlemen, of the periodic panics that appear at hill-stations (no one knows how) from a report having got abroad that so many persons were to be captured and made into *mumiai*. So long as this scare lasts, it is often extremely difficult to get persons to go messages, especially after nightfall. The article which I show you was not, however, made from human fat, but is of a mineral nature, and is sometimes known as *silajit*, being found as an exudation from the soil or in crevices of the rocks.

6. *Nahani* (*Valeriana Hardwickii*).—This is very largely exported from these hills, and appears to be used in India both as a perfume and as a medicine. According to the drug-sellers of Kangra, it is an anti-spasmodic. It seems well worthy of careful examination as a substitute for the valerian of the Pharmacopœia. The point of importance regarding it lies in the fact that, although most writers on the subject do little more than suggest that it might be used, or that it is desirable it should be used, it was found by me in every drug shop, as a regular article of trade, and was well-known to the collectors, who pointed out the living plant on the Alpine slopes as the *nahani* of their trade.

7. *Banafsha* (*Viola serpens*).—This is very largely traded in from the Western Himalaya. The interest in it consists in the fact that the true *banafsha* is doubtless the flowers of *V. odorata*—a species very much more rarely met with, and it is thus possible the Indian substitute possesses none of the properties of the drug, so much admired by Muhammadan physicians.

8. *Atis* or *patis* (*Aconitum heterophyllum*).—It is, perhaps, unnecessary for me to say anything regarding this very valuable drug further than that it forms an extensive article of trade from every town in Kangra and Kulu. I understand it was formerly issued from the Indian Medical Stores, but for some years it has been discontinued. One would naturally like to know the reason for this. Few medicines are more extensively employed by the people of India than *atis*.

9. *Aconitum napellus.*—The only form of this plant found by me on the higher ranges was a condition with very pale blue flowers and small conical roots. It is neither collected nor traded in from Kangra, so far as I could learn, though, of course, it was well known to the hill-people to be poisonous.

10. *Impatiens sulcata.*—The seeds of this very tall balsam are regularly eaten, and a medicinal oil is also said to be extracted from them, which is regarded as of special merit, but of the properties of which I could get no definite information. One seed eaten by me made me feel sick, and a second would certainly have had disastrous consequences.

Before dismissing the subject of the articles of export trade from the drug shops of Kangra, with your permission, Gentlemen, I should like to mention by name three articles which are of considerable commercial value, though they are not strictly speaking medicinal.

11. *Kut*, the Costus of the Greeks (*Saussurea lappa*).—This valuable perfume has not hitherto been regarded as exported from Kulu and Kangra. I ascertained that there was a considerable trade in the root, and I collected the plant in one or two of the ranges at 8,000 feet in height. We must, therefore, now add these regions to the published area of supply.

12. *Dhup (Jerinea macrocephala)*.—The roots (*dhup*) of this large handsome plant (*gugul*) are extensively collected and exported all over India as one of the chief ingredients of the incense burnt at temples. That article, as prepared on the hills, consists of the roots of this plant made up with the wood, leaves and berries of the juniper, a little *jatamansi*, sandal-wood and camphor. While examining the ingredients employed in incense, I observed that the traders kept pepper-corns with their camphor, and I was told that these prevented the evaporation of the camphor. I have heard this stated before, but have not as yet had an opportunity of definitely testing the truth or otherwise of the statement. If it be true, the fact should be of great value to Museums.

13. *Madder* or *manjit* (*Rubia cordifolia)*.—The roots of this most valuable dye plant appear to be regularly collected all over Kashmir, Kangra and Kulu. This fact does not seem to be sufficiently well-known to the trade, and it is possible that as aniline dyes find their way more completely to the remoter tracts of the Himalaya, like the *al* dye of the Central Provinces, the *manjit* of Kangra will disappear from trade.

These are a few of the regular articles seen in the drug shops of Kangra, but before leaving that province, I shall like to invite your attention to five articles of the herbalist stalls.

14. *Rhamius davuricus* (*segul*).—A common tree throughout the regions from 5,000 to 7,000 feet in altitude. The fruit and juice are regarded as drastic purgatives. If this could be utilized, an indefinite supply exists.

15. *Podophyllum emodi.*—The large scarlet fruits of this plant are universally eaten and relished by the people, and they are not purgative: the roots are recognized as a useful purgative. The number of persons that make a living by collecting and exporting drugs from the higher ranges of Kangra and Kulu is very great. The demand exists for *karu*, *dhup*, *kut* and many such, and these are regularly exported. If, therefore, the European merchants wish to procure podophyllum, they should find little difficulty in orga-

nizing an agency. From the examination of this root (instituted some few years ago), it appears to be remarkably rich in the officinal resin. India should not only, therefore, meet her own demands, but very largely contribute to the world's supply.

16. *Balanophora involucrata.*—This most remarkable plant I found recognized as a drug and sold as *gajpipal.* The properties (or supposed properties) I could not discover.

17. I have not thought it necessary to place before you a long list of the medicinal products collected by me, but which I could not discover the exact sources of, since they were not in season during my visit. I shall, however, draw your attention to two such products. *Malin*, a root sold in Palampur and elsewhere, and said to be very valuable in killing maggots and lice.

18. *Mathosan*, a member of the umbelliferæ, which I have not had time to critically examine, but which appears to be *Selinum tenuifolium.* One person gave me the name *Bhutkesi* for these roots—a name hitherto assigned to *Corydalis Govaniana*, but it would appear this same mistake has been made on more than one occasion here mentioned, since considerable confusion exists in the literature of *Bhutkesi.*

The roots of *Mathosan* are sold all over Kangra and Kulu for the purpose of causing the fermentation of *sur* or beer. They are made into cakes with barley, and these cakes are sold as *Dheli*, and are probably identical with the *Paps* of the Tibetans. This subject is of the greatest interest, for in these prepared barley and *Mathosan* cakes, we possess a substance that is said to keep good for a long time, and a small fragment of which may be relied upon to produce fermentation, or may be employed in raising bread. To the numerous officers in India, who spend many months together in camp, these small fermenting cakes should prove of the greatest service, and it seems just possible that this obscured fermentation agent might even be of value to the brewing industry.

19. Some few years ago I had occasion to be travelling in the Sutlej Valley. I witnessed there the leaves of *Adhatoda vasica* being scattered over a flooded field of rice. I enquired the object, and was told these acted as a medicine by killing the insect and fungoid pests of the rice crop. My attention being thus directed to this subject, I conducted many experiments with the result that the cultivators' opinion of the plant seemed fully justified. The subject was then recommended by the Government of India to the attention of the local Governments, and much useful additional information was thereby brought to light. Shortly after this Dr. Hooper, of Madras, took up the chemical examination of the plant, and succeeded in isolating an alkaloid to which he attributed the active principle. Dr. Bamber, of Kirkee, on the other hand, subsequent to Dr. Hooper's investigations, re-examined the plant, and formed the opinion that the principle which acts as an insecticide appears to be a volatile product. In this opinion I concur with the latter chemist. In all my practical tests I failed to get good results if dried leaves were used. Within the past few months, this substance has gained a somewhat remarkable reputation as an insecticide against red spider and mosquito—the two chief pests of the tea plant. But in addition, the opinion prevails throughout India hat this is one of the most valuable plants in the treatment of lung diseases. The suggestion has, therefore, been made that it is possible the insecticide property and its value in these affections may, in some way or other, be connected. I dare not carry this suggestion further, however, without having performed the necessary experiments that would justify the conclusion these considerations point to; but, Gentlemen, I may add that I obtain frequent applications from medical men in Europe who would seem anxious to experiment with the drug. The difficulty has presented itself of being able to prepare a medicine from the fresh plant that would preserve all its true properties. I venture, therefore, to commend this subject as one out of the many undeveloped medicinal products of this country that might be fairly well expected to more than reward the energies of many investigators.

20. Before resuming my seat, I should like to invite your attention to one other subject. You are doubtless aware that the pulse *Lathyrus sativus (Khesari)* has for many years now been fully understood to cause paralysis of the lower extremities to men or animals that live on grain for any length of time. This property has been found to be due mainly to a volatile principle that is destroyed if the pulse be properly cooked. When travelling through the Nagpur District of the Central Provinces, my attention was directed the other day to a form of the plant with much smaller seeds which the natives believe is entirely free from the toxic property of the ordinary form of the plant. Thinking there might possibly be some mistake, I gave the study of the form met with on wheat *(Rabi)* lands my careful consideration since I had been informed the harmless condition of the pulse grew on rice lands, which I was to inspect shortly after. I was thus prepared to critically examine the two plants on my passing from the wheat to the rice areas, but I must inform you that when I was shewn the rice field condition of *Lathyrus*, I was utterly at a loss to find any structural peculiarity by which in the herbarium the two plants might be separately recognized. Their habitats are very different—the smaller seeded form (*lakhori*), as it is called, is sown earlier, the seed being thrown over the flooded rice-fields towards the close of the rains; the wheat-field form is sown later, on rich black soil. This, in the Central Provinces, is known as *lakh.* The opinion that, while *lakhori* is harmless, *lakh* is very dangerous, I found to be held by the inhabitants of several districts of these provinces, and even in the Berars. Indeed, *lakhori* is spoken of as a speciality of Nagpur, Bhandara and Chhatisghar Districts, and is exported all over the country on account of its being harmless. It cannot alone be the fact that it is grown in rice lands that gives this immunity, since in Oudh, the North-

Western Provinces and Behar, the rice land *Lathyrus* is very poisonous. There are no botanical characters, other than the size of the seed, to account for this remarkable chemical difference (if it be chemically confirmed that the popular reputation of the two grains is correct) ; to what then are we to look for a solution of the enigma of these curious plants ? I venture to think, Gentlemen, our ignorance of the nature and character of the products of this country is the chief cause, not only of many of our own defects, but of our want of scientific progression. It is impossible to urge, therefore, in too strong terms the desirability of greater attention being given to the study of the indigenous drugs of India. We shall, thereby, find good substitutes for imported drugs, create new trades, and prevent valuable local knowledge from being lost sight of in the new stream of Western ideas that is rapidly enveloping the whole country.

SECOND PRESIDENTIAL ADDRESS.

INDIAN PHARMACOLOGY : A REVIEW.

BY RAI BAHADUR KANNY LALL DEY, C.I.E., F.C.S.

THE immortal Darwin concluded one of his most exhaustive monographs with the words : "We only see how little has been made out in comparison with what remains unexplained and unknown." This is exactly my feeling to-day in attempting to place before you a brief review of the subject which I have made a study for more than forty years.

I am fully conscious of the responsibility attached to the office to which you have done me the honour to elect me, and I trust that you may not be disappointed in my fulfilment of these responsibilities. I am becoming more and more reconciled to the fact that advancing age constrains me to leave this legacy of work undone to younger and abler men, but I shall endeavour in the time at my disposal to lay before you a sketch of the progress of pharmacology in India with some suggestions of possibilities as to its future.

It may not be unprofitable to glance for a moment at the ancient Sanskrit Materia Medica of a time long preceding the advent even of Mohammedanism in India over seven centuries ago. I have quite lately found great pleasure and no small instruction in a research into the old Sanskrit works dealing with the classification of vegetables and the utilization of their parts in medicine as practised by the physicians of India of the Puranic era some thirteen centuries ago. The elaborate directions for the collection of drugs and their subsequent manipulation is, strange as it may seem to European minds at least, not by any means unworthy of the methods of to-day, and you will perhaps be as astonished to learn as I was to find that some of the mistakes of the most ancient of these Sanskrit writings survive in some of the best books treating of the indigenous drugs of India at the present time. They show the great progress which the ancient Hindus had made in the healing art. Minute instructions were given on every conceivable point, such as the gathering of herbs, preparation of medicines, etc. Annual plants were to be collected before the ripening of the seed, biennials in the spring, and perennials in the autumn ; twigs were to be of the present year's growth : the roots to be collected in the cold season ; the leaves in the hot season ; and the barks and woods in the rains. There were no fewer than twenty-six forms of medicine, including powders, extracts and boluses, decoctions and infusions in water and milk, syrups, expressions, distillations, fermentations, and medicated oils, many of them crude enough in their exhibition but wondrously efficacious in the respective ailments for which they were designed. Not, however, until the quickening influence of British supremacy had been fully established in India was any notable attempt made of which there is any record to improve or to augment what was already known of the medicinal resources of this country. Sir William Jones' "Botanical Observations on Select Indian Plants," was one of the earliest contributions in this direction : John Fleming's "Catalogue of Medicinal Plants" (1810) ; Ainslie's "Materia Medica of Hindustan" (1813 and 1826) ; Roxburgh's "Flora Indica" in 1820, and the labours of Wallich, Royle and, later, of Drs. F. J. Mouat and Macnamara and other ardent botanists, did much towards resolving the chaos in which they found the vast mass of material at their disposal into some degree of scientific arrangement.

The gradual progress of Indian pharmacology, the widening and deepening of its influence, and its possibilities in contributing to the health and consequent prosperity of this vast Empire have been in complete sympathy with the gradual development of commerce, medicine, and science in this country. Clear of the mythology and superstition from which, not unlike the medical science of Europe, it evolved, but which lingers still in India, the science has in some measure at least demonstrated the marvellously liberal provision of curative and remedial agents within the reach of the teeming millions of this Empire.

Following O'Shaughnessy's *Bengal Pharmacopœia* (1844), the publication of the *Pharmacopœia of India* (1868) under the editorship of Dr. Waring signalized a new epoch in the establishing of the value of indigenous medicinal products. The more important were stamped with some measure of official recognition, a preliminary step to the ultimate adoption of several in the *British Pharmacopœia*, a distinction of which many more—as I shall hope to show—are equally worthy. Dr. Moodeen Sheriff's "Supplement to the Pharmacopœia," published in the following year, added very materially to the usefulness of that work, and Dr. U. C. Dutt's translation of "Sanskrit Materia Medica" enriched this department of medical science in no inconsiderable degree. The painstaking labours of Flückiger and Hanbury, as embodied in the *Pharmacographia*, were of incalculable value in recording some most important material relating to the medicinal products indigenous to British India. Among recent authors the work of the late lamented Dymock has been perhaps the most valuable. His "Materia Medica of Western India" (1883) was a most careful compilation, while his later work *Pharmacographia Indica*, in joint authorship with Warden and Hooper, is an admirable emulation of its perfect prototype.

The comprehensive "Dictionary of the Economic Products of India" by my honourable colleague in the Presidency of this section of the Indian Medical Congress, Dr. George Watt, combines a condensation of all the literature of the subject with all the information it has been possible to secure through official and other sources. Mr. T. N. Mukherji, of the Imperial Museum, Calcutta, has, by the genuineness of his work in this department of science and his painstaking attention to details, come to be recognized as an authority on all matters relating to the indigenous drugs of India. Another earnest worker in this department at present is Surgeon Captain B. D. Basu. The science is also greatly indebted to Mr. Thomas Christy, F.L.S., London, for his unremitted exertion to discover the value of and to introduce new drugs to the commercial world.

International Exhibitions in different parts of the world and the invitations to the Indian Government to prepare exhibits infused fresh impetus into the somewhat commonplace researches into the medicinal resources of this country.

Thus attempts have been made to separate the wheat from the tares. The literature on the subject is voluminous, tending even in the best and most recent works towards reprint and repetition, and the repetition, as I have already pointed out, of statements that should long ago have been relegated to the oblivion whence they originated. In a new edition of my own little work (published originally in 1867), on the "Indigenous Drugs of India," now in the press, and the advance sheets of which I have the honour to lay before you, I have tried to remedy these defects as far as possible, to remove the errors and mistakes into which writer after writer had fallen by copying and quoting one after another, to prove all and hold fast the good.

If we look now for results we will find that Materia Medica as a science has benefited materially from these researches, that the armamenta of the unprejudiced physician has been increased with advantage, helping to raise medicine in some small measure at least out of the mire of empiricism. The medicinal properties and uses of these munificent gifts of Nature have become better known among the people, and uses that before were confined to districts have spread to larger and more useful areas. But while the example of Government is to be taken as our criterion in many instances, it is not so in this particular case. It is surely a reproach that in the latest list of medical stores for hospitals in Bengal only one country medicine—the herb *chiretta*—appears. This surely reflects either on the internal or external administration of the Medical Store Department.

It is in view of such considerations as these that I would endeavour to offer some practical suggestions as to how the more important of our indigenous drugs may be dealt with, not merely as in different substitutes for European products, but as each filling a place of its own in point of usefulness and therapeutic value.

The first consideration is that of *identification*. This will remain a prime difficulty until certain prominent characteristics of each drug become established, as no amount of verbal description will enable the non-botanical mind to identify some plants and parts which even in themselves do not invariably present quite the same characters. The ease and cheapness with which almost all the drugs of this country are to be obtained will be facilitated greatly with the help of the vernacular names peculiar to each district, as also of the professional castes who deal in these substances, the *Musheras* of Central and Upper India, the low-caste *Maules*, *Bediyas*, *Bagdis*, *Kaibartas*, *Pods*, *Chandals*, *Kaoras*, and *Karangas* of Bengal and the *Chandras*, *Bhils*, *Gamtas* of Bombay. These humble communities of the several Presidencies of India can render immense service to medical men in supplying medicinal plants. This fact was fully recognized by Sir William Jones, the President-founder of the Asiatic Society of Bengal. In the second volume of his "Botanical Observations on Select Indian Plants" he wrote :—

> "I am very solicitous to give Indian plants their true Indian appellations ; because I am fully persuaded, that Linnæus himself would have adopted them, had he known the learned and ancient language of this country. . . . Far am I from doubting the great importance of perfect botanical descriptions ; for languages expire as nations decay, and the true sense of many appellatives in every dead-language must be lost in a course of ages ; but as long as those appellatives remain understood, a travelling physician who should wish to procure an Arabian or Indian plant, and without asking for it by its learned or vulgar name, should hunt for it in the woods by its botanical character, would resemble a geographer, who, desiring to enquire by name for a street or a town, must wait with his tables and instruments for a proper occasion to determine its longitude and latitude."

The suggestion herein conveyed has been carried into effect to a large extent in such names as *Athnocephalus cadamba* and *Cedrus deodara*, but it is to be regretted that it has not been possible to widen the system in the nomenclature of plants peculiar to India.

Botanically, many of the doubtful points relating to the plants yielding these drugs have been set at rest for ever in Sir Joseph Hooker's colossal work on the Flora of British India, now completed in all but the grasses, while the index collections of authentic specimens which are in process of formation at the Imperial Museum, Calcutta, and Imperial Institute, London, to which the Dictionary of Economic Products is to form the catalogue and key, will, when complete, facilitate the identification of these products for commercial purposes. All the well-oiled machinery of this official mill, however, will not bring our acquaintance with those of our native medicines that we ought to know better out of the theoretical into the practical.

I would suggest a further step in the establishment of facilities for the supply of *reliable preparations* ready for immediate use by physicians. It is vain to expect medical officers to assume the *rôle* either of botanists or druggists. That is a condition of things which has long gone by. I have to suggest, therefore, that the medical storekeepers of the respective Presidencies should be asked to make some definite pharmaceutical preparations at their respective laboratories for distribution to the various hospitals and dispensaries for trial and report. In this way a step would be made towards their practical utilization, while the advisability or otherwise of their replacing costly imported drugs could be most readily determined. Absolute dependence ought not to be placed on individual opinion, for such may be formed from preconceived notions, or may be affected by influences or considerations which may detract from their real value. Some such arrangement once thoroughly established, however, the great Indian Medical Service will be a source of unlimited blessing to the people and will be independent of the *-ines* and the *-anes* and the synthetical monstrosities innumerable of these last days. The particular class of preparation I would favour is the general one of fluid extracts as originated in the United States Pharmacopœia, one part of the product representing one part of the original drug operated upon. They present the advantages of portability, permanence and adaptability with concentration and uniformity. I have myself made several experiments in this direction, the results of which I have the honour to present for your inspection. I am persuaded that the future of Indian Pharmacology depends largely on considerations such as I have indicated to you.

The next important point is the commercial aspect of this question. The Government of India has encouraged with a liberality beyond all precedence the cultivation of medicinal plants suited to India, and the experimental cultivation of others which have proved to be unsuitable to the soil. The result has been, on the one hand, that the cinchona industry of the world has been completely revolutionized, ruined, some will say; while, on the other, thousands of rupees have been spent to practically no purpose in the attempt to establish ipecacuanha.

The time has now come for laying out *Medicinal Plant Farms* in the districts most suited to the drugs which it is proposed to grow. There is enough belladonna on the Himalaya to supply the world which, if transplanted and carefully cultivated, would surely at least save India the necessity, if not the cost, of importing that among many other drugs which might similarly be grown. The medicinal plant and essential oil gardens of Germany and Belgium are sufficient evidence of the success attending such enterprise. Another most desirable step which would follow this in natural sequence would be the establishment of a drug emporium for India. This for obvious reasons would be most practically effected at Calcutta. A class of drug brokers would arise, whose business it would be to encourage the systematic collection of drugs for export to the great markets of Europe, Australia and America. The sorting of the drugs into their various qualities could be effected quite as easily in the Calcutta as in the London market, and the present anomalous position of the Indian druggists importing drugs which have already been shipped from India will be done away. There are thousands of tons of valuable roots and flowers, and fruits and fibres, rotting in the jungles every year for want of a proper market in which to have their approximate values appraised. Nor are they even on the Himalaya so very inaccessible. The gentian grubbers of the Alps spend weeks at a time far away from their homes collecting for the market. Some of the medicinal plant farmers about Brussels employ 500 collectors—whole families—who go out into the surrounding districts and collect the drugs which they prepare for the markets of the world. With the cost of labour at a minimum in India and material in profusion success in some corresponding degree is assured. The ever-improving railway communication should afford a great impetus to such an industry which I am confident would in time become one of considerable importance to the people of India.

Above all I would appeal to my countrymen to be honest. It is unfortunately too true that the art of sophistication and adulteration as applied to almost every commodity produced in India has served to weaken the faith even of our own countrymen in what we are accustomed to call country products. There are certain branches of industry, it must be admitted, where this process of sophistication provides quite an industry of no little importance, but I ask you, is this sufficient compensation for a diminished faith and consequent depreciation in value in our exports to European markets? I do not say that we are even approaching in ingenuity to that which created the wooden nutmeg, but I hold that the success of all that I anticipate for the indigenous drugs of India depends upon this consideration. If I may present one or two instances in the brief space now at my disposal, I would remind you that *Cannabis indica* has lost a very considerable portion of the reputation it once had in European practice on account of the fact that it is not of the same standard of quality as it was in former years. Similarly, the bark of *Holarrhena antidysenterica*, the *kurchi*, is losing its undoubted position as a specific in dysentery through the substitution of worthless barks. The aconites are equally unreliable.

Among the most important of the drugs exported at present are *Aconitum ferox*, nux vomica, Indian opium, baël, hemidesmus and Indian hemp; while among others which might form equally important articles of export are belladonna, taraxacum, podophyllin, jalap (*Ipomœa turpethum*), *Holarrhena antidysenterica*, gurjun, chaulmugra, isaphgul.

I am hopeful that considerable encouragement will be afforded to the better appreciation of our indigenous drugs by the fact that some are likely to be included in the proposed *Imperial Pharmacopœia*. In a paper which I prepared for the International Pharmaceutical Congress held in London in 1881, and which was presented on my behalf, I suggested several drugs as worthy of inclusion in a proposed revision of the *British*

Pharmacopœia. These suggestions are embodied in the following list:—

Scientific Name.	Popular Name.	Properties.
Adhatoda Vasica	*Bakas*	An expectorant.
Andropogon paniculata	*Kálmegh*	Febrifuge.
Azadirachta indica	*Nim*	Bitter tonic and antiperiodic.
Calotropis gigantea	*Akanda*	In eczema.
Carica Papaya	*Papaya*	Source of papain.
Dipterocarpus turbinatus	*Gurgun*	Substitute for copaiba.
Garcinia Mangostana	*Mangosteen*	Astringent.
Gynocardia odorata	*Chaulmugra*	In leprosy.
Holarrhena antidysenterica	*Kurchi*	Specific in dysentery.
Psoralia corylifolia	*Bàbchee*	In leucoderma.
Symplocos racemosa	*Lodhra*	In menorrhagia.

I have now attempted in the brief space at my disposal to place before you some of my views and some of my expectations which, in my old age, I cannot hope to see realised, but which, in the best interests of the great Oriental Empire of Her Majesty, I venture to hope may be furthered in some measure by this Indian Medical Congress.

THE GOVERNMENT CINCHONA ENTERPRISE IN SIKKIM.

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From its first introduction to Europe in 1639 by the Countess of Chinchon and her father confessor down to the year 1820, cinchona-bark used to be administered either in the form of powder or as tincture, infusion or decoction. In 1820 Pelletier and Caventou separated from the bark the alkaloids, which they named quinine and cinchonine. Quinidine was discovered by Henry and Delondre in 1833, cinchonidine by Winckler in 1847, and quinamine and aricine found at still later dates. Soon after the separation of the two alkaloids first mentioned, it was found that in medical practice far better results were obtained from their use than from the exhibition of any of the pharmaceutical preparations of bark hitherto employed. What was called quinine in these early days was, no doubt, a mixture of all the alkaloids contained in the bark used in its manufacture. The new drug was admitted into the Pharmacopœia under the name of quinine, and it is only in comparatively recent times that the other alkaloids were even mentioned in the Pharmacopœia far less admitted as officinal.

The medicinal cinchona trees are all natives of the great forests of the Andes of South America. As the consumption of their barks extended in Europe, the trees in the Andes gradually began to disappear, the bark-cutters having year by year to explore forests more and more remote from the coast, and no system of conservancy was ever enforced by the various Governments in whose territories the trees occur. The result of all this was that the price of cinchona-bark steadily increased, and as the demand for it also increased, serious fears began to be entertained of the complete extinction of cinchona in its home in South America. The Government of India have, for many years, been the largest consumer of febrifuges in the world; and the Dutch Government were also, by reason of their Malayan possessions, much interested in the bark trade. These Governments were accordingly the first to take any action to avert the impending calamity. The suggestion to introduce the medicinal cinchonas to the hill ranges of British India was first made in the year 1835 (*i.e.* fifty-nine years ago) by Dr. Forbes Royle, a Member of the Indian Medical Service. Dr. Royle was at that time Superintendent of the Hon'ble Company's Garden at Saharanpur. In the years 1847, 1853 and 1856, Dr. Royle repeated his suggestions, but no action was taken upon them. In 1850 Dr. Grant, then the Hon'ble Company's Apothecary General in Calcutta, took the matter up, but without result. In 1852 Dr. Falconer, who was then Superintendent of the Calcutta Botanic Garden, again brought it forward; but also ineffectually. Dr. Falconer's successors at the Botanic Garden, Dr. T. Thomson and Dr. T. Anderson, also both successively pressed it on the attention of Government; and in 1858 active measures were at last taken which resulted in the establishment in 1861 of cinchona plantations in the Nilgiri Hills and in the British Sikkim, near Darjeeling. A little before this the Dutch Government had also began plantations in Java. As soon as the trees thus established in British India began to yield seed, that seed was freely distributed to all applicants, with the result that, before many years had elapsed, not only had the Government plantations been greatly increased, but thousands of acres in the hill ranges of Southern India and in the uplands of Ceylon had been covered with cinchona trees by the enterprise and energy of private planters.

Soon after their plantations began to yield bark in sufficient quantity, the Government set about discovering the best mode of utilising it. The first bark to be dealt with was red bark, the produce of *Cinchona succirubra.* This species had proved much more easy of propagation and a much faster grower than the species which are, *par excellence*, quinine-barks. Red bark, although rich in its yield of total alkaloids, is not proportionately rich in quinine, and is never chosen as a bark from which to manufacture that drug. With the view of making the most of the red bark of which they had become possessed, Government appointed a commission of medical officers to test the respective values as febrifuges of the alkaloids which are found in *succirubra* bark. The result of these experiments was to prove that, while quinine is the best febrifuge, cinchonidine and cinchonine have also much value. Government therefore resolved on the issue of a preparation which should contain all the alkaloids of red bark in the exact proportion in which they naturally occur in it. The preparation which resulted is the well-known cinchona febrifuge. When this preparation was subjected to analysis, it was proved to contain, besides the three crystallizable alkaloids just named, an uncrystallizable alkaloid, the existence of which in cinchona-bark had not previously been suspected. This alkaloid still remains without any other name than *the amorphous alkaloid.* It is a far more powerful febrifuge than quinine, a quarter of a grain of it being a sufficient dose for an adult. But it possesses depressing and nauseating properties which prevent its use in an uncombined form as a medicine. There is no doubt, however, that it is the presence, in small proportion, of this alkaloid in cinchona febrifuge which makes that drug a remedy for fever equally powerful with quinine, although rather more unpleasant. When cinchona febrifuge was first issued for use in Government hospitals and dispensaries, it was subjected to much hostile criticism, the value of some of which is well illustrated by two examples of it: One medical officer, whose report I perused, declared against the use of the drug, because he said he had found it *inert;* and, if I remember rightly, he declared that he would as soon treat his fever patients with wheaten flour as with cinchona febrifuge. Another officer, whose report I also read, excused himself from using or recommending others to use the drug on the ground that it is an *active poison.* I cannot myself offer any experimental evidence as to the value of cinchona febrifuge. The question has long ago been practically settled in favour of the drug, and the controversy need not be re-opened. Moreover, it is still being brought by private persons who are under no sort of compulsion to use it.

Cinchona febrifuge was first begun to be made in the Sikkim plantation during the official year 1874-75, but during that year only 48 pounds of it were issued to Government hospitals. During the year 1875-76, 1,940 pounds of it were given out; and its consumption increased so materially that, up to the end of the year 1887-88, no less than 87,704 pounds of it had been issued from the factory at Mungpoo. The whole of this large quantity was issued and was consumed in substitution of quinine. And it may be of interest to compare the cost of this quantity of the drug with that of an equal quantity of quinine. Cinchona febrifuge, during the whole of the period just mentioned, was sold to Government officers and to all charitable institutions at the uniform rate of one rupee per ounce. Quinine, as is well known, fluctuates greatly in price. According, however, to statistics carefully prepared by an English pharmacologist, the average rate of it in London, from 1875 to 1887, was eight shillings and four pence half-penny per ounce. The sterling value of 87,704 pounds of quinine would, at this rate, have been £587,616; and its actual cost to the Indian consumer would, even at the favourable rates of exchange which prevailed during these years, been a good deal more. The actual cost to the Indian consumer of the febrifuge, which took the place of this quantity of quinine, was Rs. 14,47,116. The saving, therefore, was very great, and was sufficient to cover the total capital cost of the plantation four times over and to leave the Government in possession of an estate from which ten thousand pounds of quinine and cinchona febrifuge can annually be turned out.

During the early part of 1888 an entirely new departure was taken on the plantation. This consisted in the beginning of the attempt to utilize the bark of the *Cinchona Calisaya*, or yellow bark, trees which, although much more difficult of propagation than the red bark trees, had then reached the number of over two and a half millions (2,669,500). The details of the processes of the manufacture of quinine followed by the European makers have always been rather carefully concealed. It was scarcely to be expected that the philanthropy of these gentlemen, even if hereditary, would be sufficiently strong to induce them to come to the help of the Government of India in this matter. To have so come would have afforded a parallel to the case of a man who, without any proclivity towards suicide, would give every facility for the cutting of his own throat. The assistance which would most probably have been denied had it been asked for was however never asked. As the result of certain proceedings, which I am not inclined to describe at length, an entirely new process for the manufacture of quinine was invented by Mr. C. H. Wood and brought into operation at the Mungpoo factory by Mr. G. A. Gammie during the year 1888-89. The process was published to the world in the *Calcutta Gazette* of March 26th, 1888, so that nobody might be able to found any patent right on it. It depends, as originally invented, on the use as solvents of fusel oil and petroleum; it involves the use of very little machinery; and is so simple that it can be worked by people who are unfamiliar with chemical manipulation. By this process there have up to date (December 1894) been manufactured 29,760 pounds of sulphate of quinine. This quinine has been issued to the Government Medical Depôts at Calcutta and Mean-Meer, and to hospitals and charitable dispensaries all over the country. Government long ago announced their intention not to enter into competition with private enterprise in the sale of quinine, while, at the same time, their policy has from the beginning been to encourage in every way the growth of the raw material from which the drug is made. In pursuance of this, none of the quinine made at the Government Factory has been sold to the general public. Cinchona febrifuge being, on the other hand, an article which no private manufacturer produces, has been from the beginning, and is still, sold to everybody who applies for it; and this privilege has already been taken advantage of to the extent (to date) of over fifty thousand pounds avoirdupois.

Few alterations in value amongst drugs are more remarkable than that which has of recent years occurred in the value of quinine. According to a table which has been furnished to me by our worthy President, Surgeon-Colonel R. Harvey, and which is given as an appendix, the average price of quinine in London during the year 1879 was, as near as may be, twelve shillings and two pence per ounce. From that year it gradually declined until, in 1887, it had fallen to about two shillings per ounce. During these years, as I have already shown, the Indian consumer was able to supply himself with cinchona febrifuge at the uniform rate of one rupee per ounce. The ultimate cause of the great fall in the price of quinine was the action of the Indian Government in distributing cinchona seed in the most liberal manner to all who might apply for it. With the seed thus freely received the planters of Ceylon almost covered with cinchona trees the coffee plantations of that island which had been devastated by the fungoid pest *Hemileia vastatrix*. When the plantations thus too extensively put out came into bearing the exports of bark from Ceylon became so enormous that the South American export of bark was completely swamped, and prices fell to a quite unremunerative limit. The fall thus brought about has been maintained until the present time, not so much by exports from Ceylon, which are rapidly diminishing, as by exports from the large tracts of land in Java, which, in a similar manner, had been covered with cinchona trees by planters who had been supplied with seed from the plantations of the Dutch Government in the Preanger Residency.

The advantages which accrued from the cinchona enterprise of the Indian Government up to the year 1888 were, to a great extent, confined to the poople of India who alone had the opportunity of buying cinchona febrifuge. The advantages which have accrued to India since 1888, although equally great, are perhaps not so striking; but they have been shared in by the whole world. For there is no doubt whatever that the enormous cheapening of quinine in recent years is due first and last to the policy of the Government in distributing seed and in encouraging by every means in their power the cultivation of cinchona trees. By maintaining their factory in full operation, the Government have been able, even while quinine fell to its lowest limit, to supply charitable institutions with pure quinine at a price below that of the best European brands. It appears as if the price of quinine had reached zero about six months ago—for it has been of late rising—and, at current rates, the best European quinine cannot be laid down in Calcutta at the rates charged by Government for the produce of its factories. The rise in price is likely to continue, for planters will certainly not go on growing produce which fetches such unremunerative rates as cinchona-bark has done for the past few years. What they had on their already existing trees the planters were bound to dispose of: but new trees are not being planted by private growers; and if raw material rises in value, quinine must at once follow. The continued maintenance of the Government plantations is, therefore, a most wise policy, because it will make the Government independent of enhanced values in the open market.

One matter of importance in this connection is too apt to be overlooked, and that is that the *Government quinine is always as pure as it can be made*, whereas much of the quinine sold in the bazars, and especially in the bazars in the Mofussil, is sophisticated with other alkaloids, and even with substances of less objectionable character. I have myself seen a sample of quinine obtained in the Mofussil which consisted of flour flavoured with some bitter substance.

But the crowning advantage of the Government Quinine Factory to the people of India is that it has enabled Government to introduce the system of selling at every village post office pure quinine in packets contaning five grains at the cost of one pice—a pice being at present exchange rates equal to a good deal less than one farthing sterling. By this step the Government appear to me to have at last realized what they avowed to be their object when they first entered in the cinchona enterprise, *viz.*, "to put the only efficient medicine for the most fatal disease in the Indian Empire within the reach of its poorest inhabitant."

Tables showing the total outturn of cinchona febrifuge and of quinine from its Sikkim Factory are given as an appendix: as also a table showing the average rate of quinine in London for every year from 1879 to 1895. The latter was furnished to me by Surgeon-Colonel R. Harvey, D.S.O., for whom it was prepared by Messrs. Smith Stanistreet and Co. of Calcutta.

NOTE.

Throughout the whole of this paper reference is made only to the Sikkim Factory, with the working of which the writer is fully conversant. Similar results have however been obtained by the working of the Plantation and Factory of the Madras Government on the Nilgiri Hills.

Table showing the amount of cinchona febrifuge manufactured at the Government Factory at Mungpoo in Sikkim from the beginning to December 1894.

			lbs.	oz.
Cinchona febrifuge manufactured during		1874-75 ...	48	10
Ditto	ditto	1875-76 ...	1,940	6
Ditto	ditto	1876-77 ...	3,750	12
Ditto	ditto	1877-78 ...	5,162	0
Ditto	ditto	1878-79 ...	7,007	0
Ditto	ditto	1879-80 ...	9,434	13
Ditto	ditto	1880-81 ...	9,296	0
Ditto	ditto	1881-82 ...	8,010	0
Ditto	ditto	1882-83 ...	10,663	4
Ditto	ditto	1883-84 ...	8,714	0
Ditto	ditto	1884-85 ...	6,464	0
Ditto	ditto	1885-86 ...	4,743	0
Ditto	ditto	1886-87 ...	6,790	0
Ditto	ditto	1887-88 ...	6,917	0
Ditto	ditto	1888-89 ...	6,384	0
Ditto	ditto	1889-90 ..	6,578	0
Ditto	ditto	1890-91 ...	4,031	0
Ditto	ditto	1891-92 ...	4,190	0
Ditto	ditto	1892-93 ...	3,481	8
Ditto	ditto	1893-94 ...	3,848	0
Ditto	ditto	1894-95 ...	2,822	0
	TOTAL	...	120,275	5

Table showing the amount of sulphate of quinine manufactured at the Government Factory at Mungpoo in Sikkim from the beginning to December 1894.

	lbs.	oz.
Sulphate of quinine manufactured during 1887-88 ...	331	8
Ditto ditto 1888-89 ...	2,191	0
Ditto ditto 1889-90 ...	1,833	2
Ditto ditto 1890-91 ...	4,010	0
Ditto ditto 1891-92 ...	4,586	0
Ditto ditto 1892-93 ...	5,242	4
Ditto ditto 1893-94 ...	4 765	0
Ditto ditto 1894-95 ...	6,802	0
TOTAL ...	29,760	14

Statement of average price of quinine from the year 1879 to the year 1894

		s.	d.
1879	Quinine per ounce ...	12	$1\frac{17}{19}$
1880	Ditto ...	11	$9\frac{2}{3}$
1881	Ditto ...	10	$\frac{5}{6}$
1882	Ditto ...	9	$9\frac{1}{8}$
1883	Ditto ...	7	$6\frac{1}{12}$
1884	Ditto ...	6	$\frac{1}{4}$
1885	Ditto ...	3	$7\frac{5}{12}$
1886	Ditto ...	2	8·28
1887	Ditto ...	1	11·9
1888	Ditto ...	1	9·68
1889	Ditto ...	1	4·3
1890	Ditto ...	1	3 4
1891	Ditto ...	1	1·04
1892	Ditto ...	1	·3
1893	Ditto ...	1	·6
1894	Ditto ...	1	2·7

THE VALUE OF QUININE.

BY SIR WILLIAM MOORE, K.C.I.E.,
Surgeon-General, I. M. S.

I HAVE on various occasions expressed an opinion that quinine is a much overrated drug. With the hope of eliciting the views of others better qualified to judge I venture to state briefly my reasons for not regarding quinine as the panacea it has been portrayed.

1. Paroxysmal fevers, especially ague, have, more than almost any maladies, a tendency to spontaneous decline. But quinine is given and credited with the cure.

2. I am not aware of any statistics of cases of fever treated with and without quinine. Some years back a commission sat for the purpose of investigating the action of the other cinchona alkaloids, and very different opinions were expressed.

3. Persons often recover without quinine. I have known Indians with severe forms of fever, who declined to take European medicines, recover thoroughly and speedily. And I have successfully treated persons without quinine. Few, of late years, have considered it compatible with their duty to treat fevers without quinine; and I might not have done so, had I not been obliged to witness the course of fevers undisturbed by quinine in the persons of those refusing to take it, or from not having quinine to administer.

4. Many things of the most opposite nature have been credited with anti-periodic powers. Years back Surgeon Hare wrote: "There cannot be a doubt that if not calomel, certainly salivation, is an antidote to malarial fever. The instant a patient's mouth is sore the fever leaves him, from that moment the disease vanishes as if charmed." Narcotin and charcoal, arsenic and cobwebs, opium and chiretta, fuming nitric acid and nitrate of potash, strychnine and *neem* bark, carbolic acid and barberry, the hyposulphites, black pepper, alcohol, coffee, water labelled peroxide of nitrogen, *cum multis aliis* of both the most powerful and inert of therapeutical agents have been given as anti-periodics. As with quinine, fevers have subsided after the use of all——*ergo* all have been lauded as anti-periodics.

5. When quinine has failed, it had been theorised that some depurating agent is required (diaphoretic, diuretic, alkali, purgative) to promote the absorption of quinine. But I can state that such agents will be equally successful without the following quinine. I recollect cases, when the patients, having taken much quinine without benefit, were put on board small vessels for change. Violent sea-sickness followed, with a result very similar to that attributed by Hare to salivation, as mentioned above. An author wrote: "In some cases, when quinine appears powerless, an emetic brings the disease at once under the control of quinine." In former years an emetic was usually given at first, and was frequently successful without any quinine. The skin, the kidneys, and, to a lesser degree, the intestine are routes by which *materies morbi*, or effete matters, are eliminated. Diaphoretics, diuretics, emetics and purgatives act on these organs.

6. Dimunition of mortality among soldiers (military statistics being the only figures available) had been attributed to the use of quinine. If diminished mortality had occurred from fevers alone, it would tend to put faith in quinine. But during recent years there has been a diminished death-rate from all maladies. This is not due to quinine, but to the abandonment of the spoiliative treatment of former days, to greater attention to personal hygiene and general sanitation, and to the comparatively large amount of invaliding.

7. How does quinine act? No one knows! It has been stated that it reduces temperature, but Dr. Zeipier has recently proved that, when the temperature is low, quinine raises it. Quinine arrests putrefaction outside the body, but that it does this inside the system may be questioned. It has been supposed to check fever by reason of its influence on the spleen. Piorry asserted that a dose of quinine at once diminished the size of an enlarged spleen. I have looked for this effect often, but never discovered it. Quinine has been supposed to kill the *bacillus malariæ*, or microbe, to which it is now the fashion to attribute malarious fevers, as almost every thing else. But what if the appearances found in the blood are not the cause but the result of the febrile condition? Into this question, however, I do not enter.

8. Although quinine may raise a low temperature, large doses lower a high temperature. But it is very questionable if temporary lowering the temperature during fever is altogether beneficial, and any advantage is frequently negatived by toxic effects. Quinine in large doses may originate convulsions, coma, collapse, epistaxis, dyspnœa, amaurosis and many other abnormal conditions.

9. Quinine may induce that for which it is given as a remedy. A condition of masked fever sometimes arises from saturation of the system by quinine.

10. In an article on the subject published some years ago in the *Indian Medical Gazette*, I quoted fifteen writers who have expressed opinions adverse to quinine.

THE TREATMENT OF MALARIAL FEVERS BY THE HYPODERMIC INJECTION OF QUININE.

BY P. S. W. BENSON,
Surgeon-Lieut.-Colonel, I. M. S.

I MUST apologise for trespassing upon your valuable time by introducing such an old method of treatment of malarial fevers as that of the hypodermic injection of quinine, my reasons for so doing are :—

1st.—Because I believe it to be simpler and far more efficacious than any other form of treatment.

2nd.—Because it is a method of medication so little used by medical men in this country.

The main objection to its employment may, I think, be thus summed up :—

1st.—The pain produced by the introduction of the needle and solution.

2nd.—The liability to the formationof an abscess at the seat of injection, followed by ulceration and sloughing of the skin.

3rd.—The possibility of the supervention of tetanus.

During the past five years no less than 1,390 cases of different forms of malarial fever have been treated in the Mysore General Hospital and Jail by this form of medication, and it is only because I can vouch for its safety and efficacy that I have been tempted to write these brief notes.

Before going into details of the effects of the hypodermic injection of quinine, I should like to say a few words regarding the kind of quinine employed ; its strength and dose ; and, lastly (by far the most important), the mode of injecting the solution under the skin. Of the 315 cases treated at the Jail I used the ordinary sulphate of quinine dissolved in tartaric acid, the strength of the solution being fifteen grains to the drachm, and of this solution twenty minims were employed representing five grains of quinine. Out of these 315 cases so treated, I regret to say, four cases were followed by ulceration at the seat of injection. All these cases occurred within a short time of each other, and during the tenure of a careless and unskilful hospital assistant.

In the General Hospital, during the years 1891-92, I employed the ordinary sulphate of quinine (stained with magenta as supplied to us by Government) dissolved in hydrochloric acid, and out of 461 cases so treated not a single bad result followed. During the years 1893-94 I have employed the neutral sulphate dissolved in water. The strength of the solution in either case was fifteen grains to the drachm, and of this solution twenty minims were used.

No less than 614 cases were so treated without a single untoward result.

Seat of injection.—In all cases treated in the General Hospital and Jail, the site selected was that point situated between the inferior angles of the scapula, but in private practice I have, for the sake of convenience both for the patient and myself, injected it under the skin on the outerside of the forearm.

Mode of injection.—Though the mode of injecting does not differ essentially from the ordinary method of hypodermic medication, there are a few precautions which, I think, should be taken, and by the observances of which, such sequelæ as abscess and sloughing of the cellular tissue, are prevented. I am convinced that it is the fear of these unpleasant sequelæ which deters so many medical men from adopting this mode of treatment.

The skin below the inferior angle of the scapula being pinched up between the thumb and forefinger of the left hand, the point of the needle (the needle having been previously aseptised) is inserted into the skin a little below the part pinched up, and pushed through the entire thickness of the skin and fibro-areolar tissue, until the point and a part of the needle are found to be free in the subjacent-areolar tissue. It is then inserted horizontally for about an inch, and the solution slowly injected. The needle having been withdrawn, the skin that is pinched up is allowed to fall, and the fluid is diffused into the surrounding tissue by means of the finger until the solution no longer raises the skin above the level of the surrounding parts.

Patients thus treated frequently complain of a slight burning sensation at the seat of injection, in addition to the pain caused by the prick of the needle, but it is very slight and only lasts for a minute or so.

In others a dull aching sensation at the seat of injection comes on some twenty-four hours afterwards, but it soon passes off and requires no treatment.

In fevers of the ordinary intermittent type, the neutral sulphate, when exhibited hypodermically, acts much more quickly and efficaciously than when given by the mouth. In the majority of cases a single injection of five grains has sufficed to effect a cure.

In cases complicated with enlargement of the spleen I have usually found that two or, at the most, three injections are required, but rarely more. In remittent fevers, complicated with gastric irritability and hepatic symptoms, this method is invaluable, and in all forms of so-called low fever which occur in people who have resided for a long time in a malarious climate, where there is a feeling of chilliness, and malaise each day, with a slight rise of temperature I invariably employ this mode of treatment and with great success. That quinine is more efficacious in this form of administration than when taken by the mouth is clearly proved by the fact that numbers of patients, who have been treated by native practitioners, or in the extern of the General Hospital for days and weeks, and have derived little or no benefit from quinine taken by the mouth, have been speedily cured by one or two injections.

Quinine administered by injection is, I am convinced, more lasting in its power of warding off fever than when taken by the mouth. Several officers whom I have treated in this way for malarial fever, and who have gone to Burma and other parts of India and been treated in the usual way, have told me that had they been treated by hypodermic injection they felt they would not only have been cured quicker, but that the effects would have lasted longer. The advantages of the hypodermic injection over the usual mode of treatment may be summed up as follows :—

1. It is equally simple.
2. That it is more rapid in its action and more lasting in its effects.
3. That it is absolutely devoid of danger and even of unpleasant sequelæ, if ordinary precautions are taken as to the site, mode of injecting and solutions employed, are observed.
4. That it is more economical and should be employed in hospitals and jails where large numbers have to be treated.

DISCUSSION.

Dr. George Watt remarked that he was a living example of the advantages of the system recommended. For eight years he suffered from malarial fever of a severe type. He was treated with quinine, arsenic and other drugs with very indifferent results. He was sent to Europe on furlough on sick leave certificate. He suffered quite as much in Scotland as in India from fever, and returned from furlough not in any way improved in health and with the fever in no way abated. Dr. Waller, in 1882, injected quinine, dissolved in sulphuric acid, on the right shoulder. The result was suppuration that lasted for a few days. But from that one injection fever left him entirely, and though for months together he had slept under trees and explored botanically the most malarial districts of India, he never once had the very slightest return of fever from that day to this.

Dr. Benson, in answer to questions put, stated that he never saw a single case of abscess following the injection, and that he usually followed this form of treatment in all cases, even of ladies and children. He does not think that five grains is the largest dose that can be administered with safety, but as he always found five grains to be sufficient, he had no occasion to exceed it. As regards accessory treatment : In ordinary cases of intermittent fever, he invariably administers a purgative to begin with.

INDIGENOUS DRUGS OF INDIA.

BY R. P. BANERJEE, B.A., G.B.M.S.L.

ABSTRACT.

Calotropis gigantea (*Madar*) has been described as anodyne, diaphoretic, alterative and tonic. It has been used in febrile affections as diaphoretic and expectorant. It has also been used with effect in syphilitic and other skin diseases. The leaves have been found good as an external application to inflamed joints.

Tribulus terrestis (*Gokhura*) is demulcent, diaphoretic, diuretic and tonic. As diuretic it has been used in gonorrhœa, cystitis, spermatorrhœa and fevers. It is also described as a galactogague, not only in women, but also in the cattle. Applied externally to the eye as poultice, it has a soothing effect.

Gynandropsis pentaphylla (*Hurhur*) is described as laxative, antispasmodic and antiphlogistic. It has been used in colic, rheumatism and bronchitis with success. Applied externally it acts as an anodyne in acute inflammation and otalgia. It also produced good results in amenorrhœa of weak females.

Sphoeranthus mollis (*Mundu*) is described as a strong nervine tonic, diaphoretic, and stimulant expectorant. It has been used in pneumonia, bronchitis, pleurisy, remittent fever, pericarditis, and acute rheumatism, with good results. It also acted well in cases of nervous exhaustion.

Carica papya (*Papaw*) is a good stomachic tonic and sedative of the gastric nerves. Pieces of the fruit have been given after meal as very good help to digestion. Used in the same way it acts well in enlarged spleen. It has been also found efficacious in the vomiting of pregnancy. Externally the juice removes warts, has also been used in leucorrhœa (5 per cent. solution).

Pinospora cordifolia (*Golancha*) is a good tonic and febrifuge, and does not produce gastric irritation like quinine or arsenic. May be safely used in fever during pregnancy. It has also been used with good effect in urinary complaints, as gonorrhœa and cystitis. The infusion, when injected in the rectum, acts as a vermifuge. It also acts as a galactogague in women. The leaves may be used as poultice to inflamed glands.

Nerium odorum (*Karabi*) is described as tonic, vermifuge and emetic. Its tonic properties are most marked upon the cardiac muscles, like digitalis, and therefore it has been successfully used in myocarditis, renal dropsy and eclampsia. It has been also used with good, results in chronic dysentery, rheumatism and leprosy.

Corchorus fascicalaries (*Bhupeti*) is demulcent, tonic and alterative, and has been used in cough, bronchitis, cystitis, gonorrhœa and incontinence of urine. In gonorrhœa it simply stops the discharge.

Boerhaaia diffuse (*Punanaba*) is described as diuretic, diaphoretic, alterative and expectorant. As diuretic it has been largely used in dropsy and cystitis. It has also been used in bronchitis and pleurisy. In amenorrhœa it acts as a tonic, and in hæmoptysis as a hæmostatic remedy.

Butea frondosa (*Dhák*) is tonic, stomachic, febrifuge and astringent. Has been used in diarrhœa, dysentery, and externally in leucorrhœa with success.

Solarum Jacquini (*Kantikari*) is tonic, diaphoretic, expectorant and alterative. As diaphoretic it has been used in rheumatism, pleurisy, pneumonia and fevers. It also checks diarrhœa and dysentery. Locally it acts as hæmostatic in piles, also used in burns.

Ricinus communis (*Bherenda*) is purgative, antirheumatic, antiphlogistic and galactogague. As purgative it is better suited to Europeans than the vegetable-eating natives. The leaves applied to the breast improve the quality and quantity of milk in nursing women. The same effect was also noticed upon cattle when given internally. The leaves also act as stimulant upon chronic sores.

Adhatoda vasica (*Bakas*) is described as expectorant, alterative and hæmostatic. It has been used in fevers, bronchitis and irritative cough. Its action is similar to that of ammonium. As alterative it has been used in syphilis and chronic skin diseases. The leaves have been applied locally to soothe inflamed scrofulous glands.

Achyranthus aspera (*Apang*). The root, juice, the entire plant, and the friuts have been used as medicine. It is described as diuretic, diaphoretic, expectorant, alterative and styptic. It has been used in dropsy and gonorrhœa as diuretic. Its alterative properties are very well manifested in syphilis and chronic skin diseases. As hæmostatic it has been used in menorrhagia and hæmoptysis with very satisfactory results. It is further supposed to be a very good cardiac tonic. A deadly pallor of the face and frowning expression have been observed during the administration of this medicine.

Cassia fistula (*Amaltas*) is described as drastic, purgative. It has been used in jaundice and severe constipation. It may be advantageously combined with tamarind and carminative.

Alangium lamarkin D. C. et Jux (*Akol*) is diaphoretic, diuretic, emetic and alterative. Has been chiefly used in rheumatic affections, skin diseases, and joint diseases. It is also held to be abortifacient.

Artemesia indica (*Gandhamar*) is tonic, alterative, diaphoretic, emmenagogue, vermifuge and diaphoretic. It has been used in acute fevers and bronchitis. Its tonic properties are most marked when used in convalescence after protracted illness. As a vermifuge it is efficacious in tape worms.

Euphorbia antiquorum (*Sehund*) is described as alterative, tonic, cholagogue and expectorant. When used externally it acts as a rubifacient medicine. It has been used in fevers with or without lung complications with good results. Its alterative effects have been observed in syphilis. The fresh juice alone is useful, the stale juice being useless.

Physalis somniferœ (*Aswagandha*) is described as diaphoretic, drastic, alterative, and tonic. The last effect is most marked in the sexual organs. It has been used in fevers, bronchitis, headache and cough with good results. In functional amenorrhœa and sexual debility in men, it has been used with success. It has been found efficacious in the vomiting of pregnancy.

Hibiscus exulentus (*Bhindi*) is described as diuretic and demulcent. Mucilage extracted from the root is used in gonorrhœa, cystitis and irritative cough. It relieves irritation of the genito-urinary passages. In infantile diarrhœa it may be given with sugar and aromatics.

Aloe litorates (*Ghritakumari*) is alterative, tonic, purgative, cholagogue and demulcent. As purgative it acts somewhat like aloes. It has also been used in amenorrhœa and leucorrhœa with success. Locally it forms a soothing application in sores, boils, etc. It is also supposed to be an aphrodisiac.

Argemom mexicana (*Sealkanta*) is alterative and antiphlogistic. Has been largely used in rheumatism and chronic skin diseases as eczema, psoriasis, ecthyma with success. The oil is laxative. The powdered seed has been used in colic with good results. The oil is largely used in phthiriasis; but it acts simply by relieving the irritation and has no action upon the lice. The fresh juice is a good local application in granular lido. The oil has a soothing effect upon inflamed surfaces.

Hyoscyamus Inanus (*Koti-bhang*) acts like *hyoscyamus*, is alterative, tonic, sexual stimulant and narcotic. The green extract is applied locally as anodyne and also internally in arthritis, sprains, lumbago, pleurodynia, periostitis, synovitis and other painful diseases. It has also been used in painful chest affections as shown in cough. Local application may cause death or abortion.

Clitoria ternata (*Aparajita*) is alterative, tonic, purgative and antibilious. It has been used in bronchitis, pneumonia, acute rheumatism with satisfactory results. Under it the skin and the kidneys were excited to free action. The *seeds* act as drastic purgative like jalap or aloes. It may also be used in dropsy of cardiac origin. As alterative it has been used in skin diseases.

Rhazia stricta (*Iswarre*) is used as alterative demulcent in syphilis and skin affections. Has also been used in fevers.

Pegamus Harmala (*Harmala*) is narcotic, antispasmodic, antiphlogistic, emmenagogue, diaphoretic and diuretic. It has been used to produce criminal abortion. Fakirs smoke it for the sake of its stimulant and narcotic properties. It has alse been used in incontinence of urine.

Cyperhus rohindur (*Nagarmotta*) is alterative, diuretic, diaphoretic and demulcent. Externally it acts as a deodorant and emollient. It has been used with good results in fevers, pneumonia and pleurisy, as diaphoretic and stimulant expectorant. Warm poultice made of the leaves retards pain in sores, boils and inflamed joints; as diaphoretic it does not cause depression.

Urthama coagulan (*Panur*) is antiphlogistic, tonic, hæmostatic, demulcent and astringent. It is largely used in diarrhœa and dysentery and bilious and sympathetic vomiting with good results. Has also been used in scrofulus ophthalmia and mammary abscess. In gonorrhœa it checks the discharge. It coagulates milk and hence its name. It is supposed to be a sexual stimulant.

Nizila sativa (*Kalajira*) is aromatic, tonic, carminative and alterative. It has been used in amenorrhœa with very good results. Has also been used in jaundice, cough, cold, periostitis and chronic rheumatism.

ANTI-MALARIOUS DRUGS.

BY T. N. MUKHARJI, F.L.S.

(ABSTRACT.)

THE writer said that malarious fever first broke out in his village (Rahuta District, 24-Parganas) in 1862, and he suffered from it for three years. He has, therefore, paid considerable attention to the subject, especially with regard to its cause and remedy. Speaking of the cause of malarious fever the writer remarked: What a number of things, old and new, got blamed on account of this unwelcome visitor? The air, the water, the land, the undergrowths and the railways have all got their due share of blame. But the air, the water and the jungles were there from time immemorial, and it is therefore the new thing, *viz.*, the railway, that has incurred the greatest odium. And truly enough it was the year in which the Eastern Bengal Railway first interfered with the drainage that the malarious fever first appeared in his part of the country. But whatever might have been the cause, or causes, and whatever might have been the modifications in the existing conditions that first brought this huge calamity upon the land, life, if it had any vitality, ought ere long to have adapted itself to the altered circumstances after the preliminary weeding had taken place of the weak, the infirm, and those otherwise unfit to live. It has so happened in other places. In the Pilibhit and Oudh Terai, where the air acts as a poison to the denizens of the plains lower down, the Tharus thrive and assiduously cultivate one of the finest kinds of table rice in the world. In the Bengal Terai, where the atmosphere is laden with miasma of the most virulent type, the Mechs enjoy almost a perfect immunity from fever and freely roam about, hunting in the forests and fishing in the creeks. But the human system in our villages has not yet been able to adapt itself to the malarious effluvia as the Tharu and Mech systems have done in some of the deadliest quarters of the globe. The people in 1894 are as much subject to the disease as the people were in 1862, and not only is there no indication of this adaptation, but there seems to have been a deterioration in the physique of the generation of children that has sprung up since the first outbreak of the fever. The Bengali race in these parts seems to be getting more and more enervated and less and less able to resist the destructive influences that constantly wage war with life in all ages and in all climes. The strong-bodied forefathers of our race held in contempt the malarious poison breathed by the silted-up jhils, the currentless dead rivulets, the water-logged rice-fields and the noxious undergrowths, but under which now easily succumb the enfeebled system of their descendants. This deterioration, and consequently this want of resisting power, are, in my opinion, due to the diminished use of animal food compared with former times. Meat never formed an important article of food in Lower Bengal, but it was the fish and the milk and its products that constituted the chief animal food of the country. The supply of all these articles has considerably diminished within the last hundred years. The numerous branches and branchlets of the great rivers that intersected the country in all directions and the crescent-shaped jhils that dotted the land, in which swarmed fishes of all kinds, have more or less dried up, thus cutting off one of the main supplies of animal food to which the people have been accustomed from ages past. The supply of milk has also considerably diminished by the grazing and waste lands being brought under the plough, and the people as yet having failed to see the advantage of cultivating fodder crops for their bullocks and their cows. The human body must possess sufficient vitality to resist the invasion of poisons from outside and for medicines to be effective in counteracting the mischief caused by them.

One medicine, though not an indigenous one, has performed wonders in counteracting the malarious poison. If not for anything else, the Old World must always remain indebted to the New for at least three things—the maize, potato and quinine. Among the innumerable things for which India must always remain grateful to England, not the least is the introduction of potato and cinchona. How many millions of lives might have been saved if, at the first outbreak of the malarious fever, Dr. George King's cinchona febrifuges were as abundant and cheap as they are now?

But are there no indigenous drugs equal in value which the people can easily gather and use? "Where the disease is, there the remedy is," is a saying that cannot be said to have been spoken in vain. Year after year we go shivering with ague, while perhaps priceless remedies go rotting in our jungles. Ancient remedies and ancient methods, no doubt, failed to cope with the heavy mortality that overwhelmed the country at the first outbreak of the fever. New methods, as inculcated by modern sciences, are therefore required to subject our herbs and drugs to a critical examination, to discover their virtues and to separate the active from the inert principles contained in them. In order to draw the attention of professional men, I would, therefore, mention the names, out of many, of only a few products coming under the first two letters of the alphabet A and B, which, as medicines for malarious fever, might with advantage be put to a more critical examination than has hitherto been their lot to receive. A full list of such substances will be found in that most valuable work Dr. George Watt's "Dictionary of Indian Economic Products" and Dr. Kannye Lal Dey's forthcoming work on the "Indigenous Drugs of India."

Aconitum netrophyllum (Atir)—The root is official in the British Pharmacopœia. It is held to be a good antiperiodic medicine, failures being due to adulterated samples obtained in the bazar.

Adhatoda vasica (*Bahas*)—Has long been known as a remedy for chest affection. Lately the powdered root has been used in malarious fever by the native doctors of Mysore. Its germicide property ought to exert a great influence upon the germ of malaria.

Alotenia Scholisis (*Chhàtin*) is a common plant. The substance *Dartam* obtained from its bark is said to be as efficacious as quinine in malarious fevers. In one case a tincture prepared from this substance acted wonderfully well in small doses.

Androglis panderlata (*Kalmegh*).—During the late epidemic of influenza this medicine was largely used as prevention of chest troubles. For a long time it has been known to be a vermifuge and febrifuge. It is considered useful in fever with enlarged spleen and liver, specially in children. Its bitter taste may be corrected by proper means.

Aristolochia indica (*Isarmul*)—Has been recognized as a medicinal plant for a long time. It is particularly efficacious in malarious intermittent fever.

Astuneson Kelgeri (*Dona*) is held to be as efficacious as cinchona in malarious fevers. It is further believed to be tonic, antiscorbutic, antispasmodic and expectorant.

Baringtonia racemosa (*Samudraphal*) is common in the Sunderbuns. Its root is supposed to possess the properties of cinchona.

Barberis aristata (*Rasaut*).—The extract of the root Rasaut is a well known remedy for malaria. The root bark is supposed to have similar properties.

Bhuma labra (*Koksim*).—It is efficacious in tertian ague. On the morning of the expected paroxysm a few leaves are put within a piece of cloth, crushed, and the smell taken till the time of the paroxysm is over. The fresh juice is also taken internally in hæmoptysis with good results.

In connection with Mr. Mukharji's paper Dr. Kannye Lal Dey added that the liquid extract of *Calotropis gigantea* (*Akanda*), as prepared by him from the entire plant, was an excellent antiperiodic medicine. It cut short the fever in five minim doses during intermission repeated every six hours.

In remittent fever it gradually reduced temperature and shortened the period of suffering.

It was a hepatic stimulant and corrected torpidity of the liver and relieved congestion of the spleen. In his opinion it was an efficient substitute for quinine in malarious fever.

HÆMOSTATIC PLANTS.

BY GRISH CHANDRA BAGCHI.

(ABSTRACT.)

DR. GRISH CHANDRA BAGCHI contributed a paper describing the properties of the following plants:—

Sarase indica (*Asok*) is described as hæmostatic, tonic, astringent and alterative, and has been used in hæmorrhage with good permanent effect. It has been used as menorrhagia very largely.

Eupatorium Ayapana (*Bishalya-karali*) is described as antiseptic, tonic and demulcent, and has been used by Dr. Bagchi in piles, hæmaturia, menorrhagia, hæmoptysis and worms, and other forms of hæmorrhage with success.

Blumea densiflora (*Kuksim*) is described as astringent of the intestinal tract. It is said to induce intestinal contraction.

Nymphœa rubra (*Rabta-kambal*) is described as hæmostatic in uterine hæmorrhage.

Dr. Kirthibar (Bombay) asked whether plants like *Blumea densiflora* were common in Bengal. He further said that the meeting ought to be grateful to Dr. Bagchi for dwelling on the important therapeutical properties of Indian drugs.

TINOSPONA CORDIFOLIA.

BY RAIGANGA SING BAHADUR,
Assistant-Surgeon.

(ABSTRACT.)

Tinospona cordifolia (*Hindi-Guruch*) is tonic, alterative, antiperiodic and diuretic ; has been used with good results in ague, debility, jaundice and skin diseases. Five different preparations are made, *viz.*, the tincture, the infusion, the compound decoction, the juice and the extract.

DISCUSSION.

Dr. Watt remarked that there was a property attributed to the plant, which he hoped might receive some consideration, *viz.*, its reputed merit of preventing milk from becoming sour. He had recently found another plant that had the same property assigned to it by the hill-tribes of the Himalaya, *viz.*, the tubers of the Orchid *Sativum Nepalense.* If either or both on their being chemically examined were found to act in the direction indicated, the subject was of very great interest to India, especially in the light of dairy farming and the milk-supply of the larger cities.

THERAPEUTICS OF CALOTROPIS GIGANTEA.

BY DR. JOHN MORTON.

(ABSTRACT.)

THE writer first deals with its effect in eczema. His first case was an Irish lady, about 40, who had been suffering from eczema of the arm, extending from the axilla to the tip of the fingers, for nine years. All sorts of remedies, including antirheumatic medicines, had been tried without any good result. A poultice prepared with the leaves of the *mendar* plant was first cautiously applied over one of the fingers which showed signs of improvement from the next day, the erupting having stopped, and was healed completely in two or three days more. The whole arm was cured within a week by this medicine alone.

He does not think it necessary to read the notes of ten more cases of eczema, similarly cured in the "twinkling of an eye" by similar treatment.

He further quotes an extract from the *Madras Mail*, in which a farmer, suffering from facial neuralgia, describes how he was radically cured by smearing the face with the milky juice of the plant, but not without suffering from blistering of the whole face.

A lay friend of the writer uses it in cholera with pepper and salt with good results.

A leprous ulcer was cured by the juice.

EFFECTS OF TRIBULUS TERRESTRIS IN HEALTH AND DISEASE.

BY DR. CHAITAN MAL.

(ABSTRACT.)

THE writer first makes a long quotation from one of his own articles in the *Indian Medical Gazette* (1876), in which he described the above medicine as being useful in quick ejaculation, nocturnal and diurnal involuntary discharge of semen, dribbling from the urethra for some time after, constant irritability of the bladder, incontinence of urine and other genito-urinary complaints.

He then records the notes of eleven cases in which he deals with the different symptoms as affected by the drug separately. Thus, out of the eleven, there were *involuntary discharges* in eight, and of these, three were completely cured, one was probably cured, one had a relapse after two months, one had his complaint aggravated by it, and two had no benefit.

Again ten complained of *quick ejaculation*, and of these there was satisfactory improvement in five, slight improvement in one, none in two, and in two others the result is not known.

As regards the power to control micturition, eight out of the eleven had no complaint in this respect, three cases had complained in this respect, and were all of them benefited by *gokhum*. Seven out of the eleven did not complain of dribbling after micturition. Of the remaining four who had this complaint all were improved considerably under *gokhum*.

Again in ten there was *imperfect erection*, and of these seven met with considerable improvement in this respect while taking *gokhum*, and three had no improvement.

Four complained of *thinness of the semen*, in two of whom there was decided improvement, and in two the result is unknown.

In one case the quantity of urine increased under twenty-five grains of *gokhum* administered twice a day.

There was tenderness of the lower part of the spine in two cases, and in both of them it vanished under treatment with *gokhum*.

These results correspond closely with those published in the *Medical Gazette*. He further gives the report of nine cases, all healthy persons, upon whom it was administered, from which he concludes that *gokhum* has different effects in different doses, and that while it is a sexual tonic in one-grain doses (extract), it is a depressant in three-grain doses and upwards. It probably acts upon the lower part of the spine, where the centre of micturition, erection and ejaculation are situated.

ON THE UTILITY OF VAPOR OPII AS A REMEDIAL AGENT.

BY DR. MANOCKJEE D. CAMA, L. M. S.

I THINK I may well clear the ground by stating at once the main object of inditing this paper.

It is nothing more than to claim, so to say, an officinal recognition of vapor opii. In short to request the powers that have to do with the responsibilities of the revision of the *British Pharmacopœia,* to recognise the importance of vapor opii, and to give it a place along with the other officinal preparations of opium. Now when the sway of the *British Pharmacopœia* is as extensive as the sway of the British Flag, it needs to be revised with the light of experiences of the whole British Empire. Indeed, it is this main self-evident fact as it were that has called all of us here together, from all the corners of Her Majesty's Dominions in the East, to bring forward the light which shines on this side of the British Empire; and, so to say, aid the revision of the *British Pharmacopœia* as to render it as complete as possible, so as to enable it to meet the exigencies of this world-embracing British Empire.

Though vapor opii has not yet found its place in the *British Pharmacopœia,* it is well-known to the medical profession working in this part of Her Majesty's Dominions, and its use is as extensive as that of any of the oldest and the best of our existing officinal preparations. I make bold to say that it is the most common way of utilising the beneficial influence of this divine drug in India, and when I add to this its extensive use in China, I think the claim of vapor opii for officinal recognition simply becomes irresistible.

Hitherto, opium is smoked in the East as *chundoo* and *madat*, which are the same, except that the latter contains watery vapour, while the former does not. As *chundoo*, the dessicated bead of opium extract, is placed on the pipe-hole ignited, and the almost dry vapour arising is inhaled, in *madat* the vapor opii formed by the ignition of the ball of *madat* passes through a quantity of hot water in the bowl of the *hooka*, and thus is charged with the warm vapour of water before it is actually inhaled. This is the whole difference, and the effect vary, as much as they are liable to vary, in a dry or moist inhalation of any other drug.

Thus the vapor opii arising from pure unadulterated *chundoo* or *madat*, dry or moist, as the case may be, when inhaled, acts directly on the respiratory tract and indirectly on the system at large. The vapour on reaching the alveoli is brought into almost direct communication with the blood, as it passes through the spongy texture of the lung-tissue, and is readily absorbed. And thus it acts as a direct sedative to the lungs, soothing cough and irritation of the larynx, restores the respiratory rhythm, promotes expectoration, relieves the spasm of the bronchi, and dilates the pulmonary arterioles, and by thus diminishing resistance to the onward passage of the blood relieves the impeded and embarrassed circulation. It also dilates the arterioles of the skin, and causes free diaphoresis, and thus relieves the internal congestion of the viscera, and helps the elimination of deleterious products, and promotes absorption and assimilation of food, and thus helps the building of tissues. Thus you will see, and I hope agree with me, in thinking that if the vapor opii is admitted to the officinal list, we would, all of us will, legitimately acquire one more weapon, and a very potent one, indeed, to assail various long affections by a direct assault, instead of uselessly trespassing on the domain of the stomach, which so often rebels so successfully as to force us to respect its neutrality, and to seek some other channel of attack equally unjustifiable.

I hope that on the eve of the publication of the report of the Opium Commission, which has served the purpose of dispelling the mist that, up till now, surrounded the utility of vapor opii, you will urge the Medical Council, on whom rests the responsibility of publishing the *Officinal Pharmacopœia* to Hall mark vapor opii as an efficient remedial agent that has fascinated the East, very sublime in its simplicity, evolved out of the omniscient brains of the celestials and grounded on the rock of the accumulated experience of ages.

A PROCESS OF PRESERVING ORGANIC SUBSTANCES.

BY JAS. CLEGHORN, Esq.

(Abstract.)

The writer has been successful in inventing a process for the extermination of insects and their larvæ from tobacco, indigenous drugs and other vegetable products. He thinks that it will be a decided advantage if drugs be preserved in this way. The process consists of subjecting goods to a very mild form of transmitted heat, *viz.*, 132° to 138° F., *reducing radiation during the process to the utmost possible limits.* All goods *before* being subjected to the process have to be packed securely in paper, wood or tin, and all pasting done *before* the process with arrowroot paste. This packing in necessary to prevent fresh attack from outside.

The time taken in the process is from six to twelve hours. During the process some moisture will be expelled from the goods; but it is essential that it should be re-absorbed, and that no dew or condensed drops of moisture be found inside the packing or on the goods.

The process serves the following ends :—

1. Stifling.
2. Sterilizing.
3. Antiseptic.

The first and second ends are secured by the radiation being reduced to the utmost possible limits, thus making a high temperature for the destruction of the insect life and germs unnecessary when goods are treated in bulk. The third naturally follows. The writer leaves it open to scientific investigation to find out the changes then set up in the starch cells and albumin. He suggests that probably albumin coagulates, *plugging pores thus* causing the preservation of tissues. As a matter of fact he finds that beef subjected to this process, and hung up in some damp place, mummifies gradually without showing any signs of sweating or putrefaction. Unripe plantains in this way, even during the monsoons, become brittle; and ripe plantain assumes, after two or three months, the condition of raisins. He has tried the process with cigars and tobacco with success, and therefore hope that it may be applied in the case of drugs, which, thus preserved, may have time to mature from any attack from outside, causing a deterioration of their properties.

He has got an apparatus in a working model scale, which he is ready to place at the disposal of medical men, and he is willing to supply any information regarding the matter.

TREATMENT OF BITES OF RABID ANIMALS BY PERMANGANATE OF POTASH.

BY D. MORRISON, ESQ., M.D. C.M.

(Abstract)

Dr. Morrison began by saying that what treatment should be adopted for the bites of rabid animals so as to give the patient the best chance of escaping hydrophobia is a question of absorbing interest and importance at the present time. It is at all times and in every country important to the surgeon, but specially in India, where deaths from hydrophobia, if they are correctly reported and registered, would show a high and widespread mortality. In the following record of cases treated by the permanganate of potash, there may be some approach to answering that question. During the last seventeen years, I had so many cases of bites of rabid animals, jackals and dogs, and such uniform good fortune or success in their treatment, that I deem it worthy to lay the facts before this Congress :—

Case No. 1.—In 1879, a girl, aged ten years, was bitten on the scalp by a dog believed to be mad. Treated with permanganate of potash solution (eight to ten grains to one ounce of water), continuously keeping the bandages wet with it. The child was alive five years after, though another village dog bit by the same animal died of hydrophobia before the wound of the child had healed.

Case No. 2.—In 1880, a Mahommedan lad, aged 17 years was bitten severely in many places by a rabid dog. Treated in the above way the lad recovered. He was in good health three years after.

Cases No. 3 & 4.—A pup belonging to me, not a year old, was bitten by an undoubtedly rabid pariah dog. I kept the pup tied up to see whether it would develop hydrophobia and warned every body not to go near it. But on the fourteenth day, owing to their carelessness, two of my servants were bitten by the pup, which now showed all the symptoms of hydrophobia and had to be shot. The first man was bitten on the big-toe, causing a deep, incised wound. The second man was bitten on the right leg. The wounds were attended to immediately, carefully opened up, washed with permanganate solution and dressed, the bandage being constantly kept wet with the solution. The wounds healed quickly, and I had them both under observation for two and three years, respectively, and they were in perfect health.

Case No. 5.—A man bitten by a mad jackal on the right leg over the tibia. Was treated in the above way six hours after. He was under observation for eighteen months, and was in perfect health.

Case No. 6.—A man, sixty years of age, was bitten by a jackal on the leg. Treated in the above way ; remained in good health for one year, after which I lost sight of him.

Case No. 7.—A man bitten on the leg by a mad jackal. Treated in the above way ; was well two years after.

Cases Nos. 8, 9, 10 & 11.—A mad jackal attacked a goat tethered near a hut. The grand mother of the family came to rescue the goat, the jackal turned on her and bit her. The daughter-in-law came to her aid, and she also was bitten. A neighbour, a young man, next arrived to drive away the jackal, and he too was bitten. The jackal then disappeared into the jungle behind the village. The son of the old woman, the first victim, came home from the fields shortly after, and finding his mother and wife bitten, armed himself with a bamboo and went in search of the jackal. He had only gone a few yards from the village when he saw the jackal coming. He tried to strike it, but missed the blow. The infuriated animal rushed upon him, and, before he had time to defend himself, he was bitten on the leg. These four people were treated by me in the above way, and all of them were in good health eighteen months after.

Case No. 12.—A Mahommadan lad was bit by a jackal supposed to be mad. He came there for treatment two days after. His wounds, chiefly on the legs, were crusted over. I opened each wound, and applied the permanganate solution as in the previous cases. I believe he did as well, as I never heard of his illness.

Case No. 13.—A boat man, bit by a rabid jackal, was treated in the above way; did well, for three months, after which he was lost sight of.

Case No. 14.—A Mahomedan bit by a rabid dog; treated after 24 hours; had him under observation for above a year.

Case No. 15.—A case of rabid jackal bite, treated out in the district while on four, was well six months after.

Cases Nos. 16 & 17.—Two brothers, aged 18 to 20 and 8 to 9 respectively, sons of a carpenter in my employ. The younger being attacked by a rabid dog, the elder came to his help, whom the animal seized by the hand and would not let go its grip, until assistance came and the animal's mouth was forced open with a bamboo. Both were brought to me by their father eighteen or twenty hours after being bitten. The younger boy had an abrasion on the chest and leg, quite superficial, and easily washed and dressed. The elder lad had a deep punctured wound on the ball of the thumb, palmar aspect, and a superficial incised wound on the dorsal aspect. I proceeded to open up the wounds before applying the permanganate solution, when the father, seeing the pain his son was put to, interfered, and the lad withdrew his hand, and would not permit me to operate. I then offered to give him chloroform, but he refused, and I was obliged to let him go with a superficial application of the solution, which I feared would be of no avail. I explained to the father the grave risk he was incurring; but they seemed to prefer trusting to fate than to undergo the operation; the elder lad died of hydrophobia twenty-one days after the bite. The younger was alive and well four years after. I shall always regret that I had not first put him under chloroform, which he might have submitted to, before he felt the pain of the operation.

Case No. 18.—A Mahomedan boy of 9 or 10 years of age was bitten by a mad dog near my house. I found the dog lying under the shade of a shrub, panting, snapping the air, and saliva dribbling from his mouth. I shot him after thus making sure that the dog was really mad. The boy was treated in the usual way, and was well four years after. The mad dog bit another dog of the village. I got hold of it, tied it up and fed it daily; on the 11th it became rabid and died on the fourth day.

Case No. 19.—A Mahomedan boy, 7 or 8 years of age, was bitten by a mad jackal, together with some other men, but how many not known. The boy was treated in the usual way, and was well some years after. About eighteen or twenty days after two men, bitten by the same jackal, were brought to me. They were suffering from hydrophobia, and died in three days.

Case No. 20.—A Mahomedan Moulvi, bitten by a rabid dog; treated in the usual way; was well six years after.

In addition to these twenty cases, I have had about eight or nine other cases, of which no definite record has been kept, as it was found impossible to verify the condition of the animal, or to keep them under observation a sufficiently long time to test the results of the treatment. Of the twenty cases cited above, nine were dog bites and eleven jackal bites. Of the nine dog bites, seven were certainly rabid; and all the eleven jackal bites, the animals were presumably rabid. In every case the treatment was successful. The following is an analysis of the cases treated:—

Dog-bites.		*Jackal-bites.*	
No. 1	Certainly rabid.	No. 5	All presumably rabid.
,, 2		,, 6	
,, 3		,, 7	
,, 4		,, 8	
		,, 9	
,, 14	... Doubtful.	,, 10	
,, 16	Certainly rabid.	,, 11	
,, 17		,, 12	
,, 18		,, 13	
		,, 15	
,, 20	... Doubtful.	,, 19	

It is difficult to prove a jackal rabid. But jackals are naturally very timid and never venture to attack man. When they are bold enough to attack, specially in the day time, they may safely be presumed as mad. Owing, however, to the difficulty of proving jackals, the dog bites only may be considered here. The circumstances of the bites point to the fact that in the nine cases bitten by dogs, seven at least of the animals were mad. Under the treatment of permanganate of potash, the death-rate has been reduced to ten per cent.—a reduction which has not been obtained under any other known treatment, except that of M. Pasteur. It is probable that permanganate of potash acts by oxidising the poison, which it appears to be of the nature of toxin produced by a lowly organism with a life-history not dissimilar to that of the bacillus of anthrax.

THE USE OF ANTIPYRETICS IN INDIAN FEVERS.

BY DR. M. N. KATRAK.

(ABSTRACT.)

ANTIPYRETIC medicines act on the central nervous system like potassi bromidum, chloral, etc. They have a special action on the thermoganetic centre. By sedating the heat-regulating centre, they act as antipyretics. In moderate doses they are essential in fever. In pyrexia a poison of a narcotic origin gets entrance into the system, and either mechanically, or producing a substance of the nature of ptomaine, irritates the nervous. The antipyretics calm this irritation, and thus act as antidotes. They act similarly on the blood and tissues and depress the heart. Hence, they should be used only as sedatives.

Dose.—Four grains of phenacetin, five grains of antipyrine, three grains of antifebrin, repeated three or four times a day, are absolutely harmless. But sixteen grains of phenacetin and others in proportion would frequently cause depression of the heart, cyanosis, and slight difficulty of respiration. In large doses their use is unjustifiable. In intermittent and remittent, and the latter includes more fevers than one, these antipyretic find their beneficial use. They do not destroy the poison, but subdue the irritation of the heat-regulating centre. Typhoid is rare amongst the natives of India. I have not seen one case in my experience of twelve years.

Manner of using.—In intermittent fevers, when the temperature is above 102°, five grains of phenacetin, or an equivalent quantity of antipyrine or antefebrin, is given three or four hours. The temperature may not come down, but it relieves restlessness, etc. In remittent fevers, the drug is given during remission with quinine. There is probably more than one variety of remittent fever, some mild, some violent. Qunine does not control them. For these, antipyretics are especially beneficial. I do not use these drugs in large doses. My object is to remove discomfort and prevent irritation. They are harmful, if used indiscriminately, with a view to bring down temperature to the normal. But fevers above 102° are harmful and ought to be checked. I have but small experience of cold-baths in fevers, what little I have of them has not impressed me favourably.

To sum up.—Antipyretics in small doses are harmless. In Indian fevers they are useful, inasmuch as they lower the temperature and control the fever, thereby minimising the injurious effects of the fever poison, which is harmful if the temperature remains high with slight variations. Doses higher than eight grains do harm. They are beneficial in cases of chronic fevers which resist quinine.

USE OF ANTIPYRETICS.

BY R. P. BANERJI, B.A., G.B., M.S.L.,
Pachbadra Salt Works, Rajputana.

(ABSTRACT.)

Antipyrine.—It was used in malarious fever, acute rheumatism, and fever complicated with bronchitis, etc. In cases of quotidian and tertian fever, when given in ten to fifteen grain doses, the temperature goes down by three or four degrees, but in the presence of gastric disturbance the result is not so satisfactory. Its administration then is often followed by severe nausea and collapse.

In rheumatism its antiperiodic action is quite as marked, but its analgesic properties are insignificant. Cardiac complications are no contra-indications to its use. In cases of respiratory affections, its action is marked in those in which acute inflammatory symptoms predominate. In chronic cases it produces depression and increases the quantity of expectoration. Where given alternately with quinine, it seems to shorten the duration of fevers.

Antifebrin.—Its antiperiodic action is like that of the above, but it is more certain and powerful. It produces profuse diaphoresis. But it has a marked depressing action on the system. Unlike antipyrine its analgesic properties are marked, relieving pain and restlessness in fever patients. In acute bronchitis it allays cough and relieves the distressing tightness of the chest. Long continuance of the drug sometimes produces muscular tremor in the hands and neck, diplopia, sexual debility and amenorrhœa. Its administration is sometimes followed by rash on the body.

Eralgine.—Its effects in malarious and acute inflammatory fevers are not so uniform and valuable as those of the above. Under its use the fall in temperature is very sudden, and symptoms of depression marked. It is an excellent analgesic, but a bad antipyretic, and a dangerous depressant. In facial, frontal and occipital neuralgia, it was used with excellent results.

Phenacetin.—Its antiperiodic properties are like those of antipyrine. It reduces the temperature steadily, producing no symptoms of depression. Its action lasts between five and six hours. Its long-continued use may produce insomnia, sexual debility, general exhaustion and cutaneous eruptions.

Salol.—As a general antipyretic salol has proved of little value. But in cases of acute rheumatism and respiratory affections, it gives much relief by allaying pain and reducing the quantity of expectoration. In chronic dysentery and diarrhœa, with fœtid evacuations, it is a very valuable medicine, specially when used in combination with the gum of *Butea frondosa* (Bengal kino).

Salicylic acid and Salicylates.—Its antipyretic effects are unsteady; in some cases it does not affect high temperature, but it reduces pain and tenderness and destroys the periodicity of the attacks. Sometimes its use is followed by marked symptoms of collapse, specially in those patients who are weak and nervous. In all affections of a rheumatic nature, the salicylates promptly reduce the pain, but the effect on the temperature are not so marked. In affections of the respiratory system, they quickly control the successive secretion of mucus. Long-continued use of the salicylates may produce pain in the abdomen below the umbilicus, sleeplessness, excessive diuresis and nightmares. When used for a long time it reduces the size of a hypertrophied spleen.

ANTIPYRETICS IN INDIAN FEVERS.

BY NARESH OHUNDER MITRA,
Assistant Surgeon.

(ABSTRACT.)

THE author is of opinion that the natives of India cannot bear quinine if the temperature is 104° F., as the administration of it under such circumstances brings on toxic brain symptoms. He also states that adult Bengalis cannot bear antipyrine. He recommends hypodermic injectionof antipyrine for hyperpyrexia of heat apoplexy. He also recommends phenacetin as the safest (although not always effectual) antipyretic. He is not in favour of cold applications and baths in general practice.

FINAL MEETING.

At the final meeting, after the despatch of the business before the meeting, including the reports of Secretaries and Treasurers, it was proposed and carried unanimously that the next Indian Medical Congress be held in the cold weather of 1898-99.

The following resolutions were brought forward at the final meeting of the Congress and carried unanimously :—

Need of a Sanitary Service for India.—(1) Resolved—That the Public Health Section of the Indian Medical Congress, having heard the communication of Dr. Simpson on the subject of the present organization of the sanitary service in India and the amendments and suggestions which he has formulated for the extension and development of that service, is convinced that the health and welfare of the population, European and Native, would be greatly advanced by the carrying out of those proposals, and would be advanced in proportion to the extent to which they are carried out, and it respectfully suggests that the Government of India should give its earnest attention to them with a view to their practical adoption.

Need of a Pasteur Institute.—(2) That a Pasteur Institute for India is essential to the advancement of science, the investigation of Indian diseases in man, animals and plants, and the treatment of diphtheria as well as of those bitten by rabid animals.

Need of Scientific and Sanitary Places of Research.—(3) That this Congress, in general meeting assembled, heartily concurs in the views which have been expressed as to the primary importance to the health and welfare of the army and of the people of India, of the liberal encouragement and support by the Government of India, by the Municipal authorities and by individuals, of scientific and sanitary places of research and clinical study for the better knowledge, prevention and treatment of the prevalent diseases of India (such as cholera, malarious fevers, diphtheria, etc.), and the endowment of qualified persons for these purposes.

Need of an Act for restricting the Sale of Poisons.—(4) That the number of cases of accidental and suicidal poisoning is increasing rapidly and to an appalling measure, and that the Government be asked to pass an Act restricting the sale of poisons.

Use of Indigenous Drugs.—(5) That it be recommended to the consideration of the Government of India that an extended use of indigenous drugs is most desirable.

Protest against the Third Clause of Cantonment Amendment Act.—(6) That the unofficial members of this Congress desire earnestly to represent to the proper authorities in India and at home the mischief likely to result from the proposed Cantonment Act Amendment Bill, especially in so far as the third clause is concerned which proposes penal legislation aimed at public medical servants, and implies that they cannot be trusted to carry out loyally and promptly the orders of Government on this subject.

The following votes of thanks were proposed by Professor Reid, seconded by Surgeon-Colonel Warburton, and carried by the meeting with hearty acclamation :—

(1.) That a cordial vote of thanks be tendered to His Excellency the Viceroy for his patronage of the Congress.

(2.) That a cordial vote of thanks be tendered to His Honour the Lieutenant-Governor of Bengal for his patronage of the Congress.

(3.) That this meeting records its hearty thanks to the Government of India for the support they have given, especially as regards facilities for leave.

(4.) That a special vote of thanks be accorded to the Rector and Reverend Fathers of the St. Xavier's College for the generous way in which they have placed their buildings and services at the disposal of the Congress.

(5.) That the thanks of this meeting be given to the Presidents, Vice-Presidents, and Secretaries of Sections, and to the Members and Secretaries of the various Committees.

(6.) That a vote of thanks be accorded to the railway and steamer companies that have granted concessions in the matter of fares.

(7.) That a very especial vote of thanks be tendered to the General Secretaries and Assistant Secretary.

(8.) That the thanks of the Congress be accorded to Messrs. Thacker, Spink & Co. for their services.

It was proposed by Surgn.-Lt.-Col. Bovill, and seconded by Dr. Thornhill of Ceylon—

That a very cordial vote of thanks be accorded to Surgeon-Colonel Harvey for the brilliant manner in which he has discharged the functions of President of the Congress, for his untiring exertions in forwarding the success of the Congress, and for his courtesy and hospitality to the Members.

The vote was carried unanimously amidst prolonged applause.

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OF THE

INDIAN MEDICAL CONGRESS.

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Bagchi, Rama Prosad, Asst.-Surgn., B.A., M.D.	Agra.
Bagh, Lakshikanto	Calcutta.
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Bamber, C. J., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S., D.P.H.	Rawal Pindi.
Banatvala, H. E., Surgn.-Capt., I.M.S., M.D., M.R.C.S., L.R.C.P., L.M.S.	Calcutta.
Bancroft, C., Asst.-Surgn.	Calcutta.
Banerjee, Abinash Chandra, Asst.-Surgn., M.B.	Calcutta.
Banerjee, Abinash Chandra, L.M.S.	Allahabad.
Banerjee, Brajendra Nath, L.M.S.	Calcutta.
Banerjee, Charu Churn, L.M.S.	Calcutta.
Banerjee, D. P.	Morvi, Kathiawar.
Banerjee, Gopal Chandra	Calcutta.
Banerjee, Hari Charan, L.M.S.	Calcutta.
Banerjee, H. C., Surgn.-Major, I.M.S., L.R.C.P., L.F.P.S.	Sylhet.
Banerjee, M. N., B.A., M.R.C.S.	Calcutta.
Banerjee, Purna Chandra, L.M.S.	Benares.
Banerjee, Ram Lall, L.M.S.	Calcutta.
Banerjee, Saradoprosad	Calcutta.
Banerjee, U., L.R.C.P., M.R.C.S.	Calcutta.
Banks, C., M.B., C.M., D.P.H.	Puri.
Barry, D. F., Surgn.-Major, I.M.S., M.D., M.Ch., L.M.	Sitapore.
Basu, Adyanath	Calcutta.
Basu, Amulya Charan, M.B.	Calcutta.
Basu, Anonanda Lal, Asst.-Surgn., M.B.	Calcutta.
Basu, Ashutosh	Dibrugarh.
Basu, Behary Lall, L.M.S.	Calcutta.
Basu, Behari Lall, M.B.	Serampore.
Basu, C. C.	Calcutta.
Basu, Chandra Bhusan, L.M.S.	Calcutta.
Basu, Chuni Lall, Asst.-Surgn., M.B.	Calcutta.
Basu, D., Surgn.-Major., I.M.S., L.R.C.P., L.F.P.S.	Purulia.
Basu, Govind Chandra, M.B.	Allahabad.
Basu, Kailas Chandra, Rai Bahadur, L.M.S.	Calcutta.
Basu, Khargeshwar, Asst.-Surgn., L.M.S.	Calcutta.
Basu, Lukhinarain, L.M.S.	Calcutta.
Basu, M. N., Asst.-Surgn.	Mirzapur.
Basu, Prandhan, M.B.	Calcutta.
Basu, Priyanath, Asst.-Surgn., L.M.S.	Dacca.
Basu, Probodh Chandra, Asst.-Surgn., L.M.S.	Ghatal.
Basu, S. N.	Calcutta.
Basu, Sarat Kumar	Patna City.
Basu, Sib Chandra, L.M.S.	Dacca.
Basu, Surendranath	Calcutta.
Basu, Upendra Chandra, L.M.S.	Calcutta.
Battersby, J. C., Surgn.-Major, A.M.S., M.B., B.C.H., M.R.C.P.I.	Rawal Pindi.
Baümler, H., M.D.	Calcutta.
Beli Ram, Rai Bahadur, Asst.-Surgn.	Lahore.
Bensley, C. N., Surgn.-Capt., I.M.S., M.B., C.M.	Chanda.
Benson, P. H., Surgn.-Lt.-Col., I.M.S., M.B., C.M., M.R.C.S.	Mysore.
Berjorjee Beramjee	Kathiawar.
Bhaduri, U. C.	Calcutta.
Bhagvat, N. V., Asst.-Surgn.	Indore.
Bhagvat Ram	Calcutta.

Bhagwan Dass, Asst.-Surgn.	Jhang.
Bhagwan Das II	Jullundhur.
Bhattacharjee, Hari Mohun, L.M.S.	Birbhum.
Bhattacharjee, K. N.	Tindharia.
Bhattacharjee, Suresh Chandra, Asst.-Surgn., M.B.	Calcutta.
Bickle, L. W., L.R.C P., M R.C.S.	S. Australia.
Bilimoria, N. J., L.R.C P, L.R.C S.	Calcutta.
Bird, R., Surgn.-Capt., I.M.S., M.D., M.S. (Lond.), F.R.C.S., D.P.H. (Camb.)	Calcutta.
Birdwood, G. T., Surgn.-Lieut., I.M.S., B.A., M.B., B.C., M.R.C.S., L.R.C.P.	Waziristan.
Bissan Das, Pundit, Asst.-Surgn.	Chakeval, Jhelum.
Biswas, Jogendranath	Calcutta.
Blaker, E., M.A., M.B.	Bara Banki.
Blong, Miss L.	Bara Banki.
Bocarro, J. E., Asst.-Surgn.	Hyderabad (Sind).
Boileau, J P. H., Surgn.-Lieut.-Col., A.M.S., B.A., M D., F R.C S.I., L.M.	Meerut.
Bomford, G., Surgn.-Lieut.-Col., I.M.S., M.D., L.R.C.P., M.R.C.S.	Calcutta.
Bond, S. P.	Partabgarh.
Boodman, Miss E.	Hyderabad (Deccan.)
Borah, S., Surgn.-Major, I.M.S., L.R.C.P., L.F.P.S.	Sibsagar.
Bovil, E., Surgn.-Lieut.-Col., I.M.S., M.B., C.M., F.R.C.S.	Bankipore.
Bradshaw, A. F., Surgn.-Major-Genl., A.M.S., M.R.C.P., M.R.C.S.	Simla.
Britto, G.F., L.R.C.P., L.R.C.S., L.F.P.S.	Rangoon.
Brown	Jalpaiguri.
Brown, Miss E. M., M.D, L.R.C.P.E.	Ludhiana.
Browne, S. H., Surgn.-Lieut.-Col., I.M.S., M.D., M.Ch.	Lahore.
Bryan, Miss M. E.	Bareilly.
Buchanan, A, Surgn.-Capt., I.M.S., M.A., M.D, M.A O, M. Ch.	Nagpur.
Buchanan, W J., Surgn.-Capt., I.M S., B.A., M.B., B. Ch., L M.	Calcutta.
Buist-Sparks, A. W. T, Surgn.-Capt., I.M.S., M.B., C.M.	Calcutta.
Bull, G. H., Surgn.-Major, I.M.S, M.D., M. Ch., L.M.	Poona.
Burke, W. H., Surgn.-Major, I.M.S., B.A., M.B., B.Ch., L.M.	Poona.
Bur Khan	Lala Musa.
Burnett, S. H., Surgn.-Lieut., I.M.S., M.B., C.M.	Kamptee.
Burton-Brown, F. H., Surgn.-Capt., I.M S., M.A., M.B., B.Ch.	Assam.
Butt, F. K., L.R.C.P, L.M.	Calcutta.

C.

Cadell, Miss I., M.D., L.R.C.P., L.R.C.S., L.F.P.S.	Sialkot.
Caldecott, R., Surgn.-Lieut.-Col., I.M.S., L.R C.P., M.R.C.S.	Indore.
Calvert, J. T., Surgn.-Capt., I.M.S., M.B., L.R.C.P., M.R.C.S., D.P.H.	Mymensing.
Cama, M., L.M.S.	Bombay.
Campbell, Miss S.	Calcutta.
Cardoz, D., Asst.-Surgn.	Dharwar.
Carmichael, J. C. G., Bde.-Surgn.-Lieut.-Col., I.M.S., M.B., C.M.	Calcutta.
Carleton	Subathu.
Caudle, C. E., M.R.C.S., L.S.A.	Sibsagar.
Cayley, H., F.R C S.	London.
Chakrabarti, N. J., Asst.-Surgn.	Agra.
Chakrabarti, Behari Lall, Asst.-Surgn., M B.	Calcutta.
Chakrabarti, Ram Lall, Asst.-Surgn., L.M.S.	Lucknow.
Chambers, E. W., L.M.S., L S.A.	Calcutta.
Chambers, H.	Calcutta.
Champati, Amulya Charan, Asst.-Surgn., L.M.S.	Patna.
Charles, R. H., Surgn.-Major, I.M S., M.D., M.Ch., L.M, F.R.C S.I.	Calcutta.
Chatterjee, B. B.	Digapatya.
Chatterjee, Benoy Krishna, L.M.S.	Calcutta.
Chatterjee, D. N., B.A., M.B., C.M.	Calcutta.
Chatterjee, Gopal Chundra, Asst.-Surgn., M.B.	Dacca.
Chatterjee, H. G., Asst.-Surgn.	Bara Banki.
Chatterjee, Joy Krishna, L M.S.	Calcutta.
Chatterjee, Monmotho Nath, M.B.	Calcutta
Chowdry, B. C.	Ranchi.
Chowdry, Bejoy Gobinda, L.M.S.	Calcutta.
Chowdry, Bhagobati Kumar, Asst.-Surgn, L.M S.	Calcutta.
Chowdry, Brojonath, Asst.-Surgn., L.M.S.	Diamond Harbour.
Chowdry, Chundra Nath, L.M.S.	Beauleah.
Chowdry, Jonmejoy, L M.S.	Calcutta.
Chowdry, Nilmoni, Asst.-Surgn., L.M.S.	Bahraich.
Churamani, H. P., Asst.-Surgn.	Allahabad.
Church, Miss A. L., M.B., B.Ch., B A.O.	Rayapuram.
Clarke, J., Surgn.-Major, I.M.S., M.D, M.Ch., L.M., F.R C.S. I., D.P.H.	Lahore.
Clarke, Rev.	Nasirabad.
Clarkson, F. C., Surgn.-Capt., I.M.S., L.R.C.P., M.R.C.S.	Krishnagar.
Clarkson, J. W., Surgn.-Major., I.M.S., L.R.C.P., M.R.C S.	Nasik.
Coates, W., Surgn.-Major, I.M.S., M.D., M.Ch.	Lahore.
Cobb. R., Surgn -Major, I.M.S., M.D., L.R.C.P., M.R C.S.	Darjeeling.
Colah, M. B.	Colaba.
Coleman, A.	Montgomery.
Comins, D. W. D., Surgn.-Major, I.M S., L.R.C.P., M.R.C.S.	Calcutta.
Comley, J. M., M.R.C.S.	Calcutta.
Cook, H. D., Surgn.-Lieut.-Col, I.M.S, M.B., C.M.	Madras.
Cook, J. N., M.R.C S.	Madras.
Cooper, A. D., L.R C.P., M.R.C.S.	Surat.
Craib, J., M.D.	Newera Eliya.
Crawford, D. G., Surgn.-Major, I.M.S., M.B., C.M.	Monghyr.
Crofts, A. M., Surgn.-Major, I.M.S., L R.C.P., L.R.C.S.	Gwalior.
Crofts, W., L.R.C.P., L.R.C S.	Bara Banki.
Crombie, A., Surgn.-Lieut.-Col., I.M.S., M D.	Calcutta.
Cuffe, C. McD., Surgn.-Col., A.M S., F.R.C.S.E.	Allahabad.
Cunningham, D. D., Bde.-Surgn.-Lieut.-Col., I.M.S., M.B., F.R S., C I.E.	Calcutta.
Cunningham, J. A., Surgn.-Major, I.M.S., M.D., M.Ch.	Simla.

D.

Dadachanjee, Cowasjee Edulji, L.M.S.	Bombay.
Dadachanjee, Palanjee Hormusji, Asst.-Surgn., L.M.S.	Bulsor.
Dadarkar, Bhabani Sankar Balkrishna, L.M.S.	Bandra.
Dadina, Ratanji Rustomji, L.M.S.	Thana.
Dalal, M. K., Asst.-Surgn., Rai Bahadur	Wadhwan Camp.
Dalal, K. B., M. K., Asst.-Surgn.	Kathiawar.
Dane, A. H. O., Surgn.-Major, I.M.S., M.D., M.R.C.P.I., F.R.C.S.I., D.P.H.	Bhopal
Das, Adar Chandra, L.M.S.	Calcutta.
Das, Amar Nath, Asst.-Surgn., L.M.S.	Jaunpur.
Das, Amirta Lal, Asst.-Surgn., L.M.S.	Alipore.
Das, Annoda Prasad, L.M.S.	Calcutta.
Das, Apurba Krishna, Asst.-Surgn., L.M.S.	Chupra.
Das, Benode Behary, Asst.-Surgn., L.M.S.	Rajshahye.
Das, Chuni Lal, Asst.-Surgn., L.M.S.	Calcutta.
Das, Chuni Lal, Asst.-Surgn., L.M.S.	Dacca.
Das, Joy Lal, Asst.-Surgn.	Calcutta.
Das, Koilas Chandra	Gya.
Das, Kedarnath, M.D.	Calcutta.
Das, Madhab Krishna, L.M.S.	Calcutta.
Das, Mohendra Nath, Asst.-Surgn., L.M.S.	Tikari.
Das, Monomohan, Asst.-Surgn., M.B.	Muttra.
Das, N., M.B., C.M.	Calcutta.
Das, Nanda Lal	Calcutta.
Das, Promatha Nath, M.B.	Howrah.
Das, Purna Chandra, Asst.-Surgn., L.M.S.	Kishengunge.
Das, Saroda Prosad, Asst.-Surgn., L.M.S.	Goalundo.
Das, Sundari Mohan, M.B.	Calcutta.
Das-Gupta, Purna Chandra, Asst.-Surgn.	Mymensing.
Davis, R. E. S.	Rangoon.
Datta, Dinobandhu, Asst.-Surgn., L.M.S.	Seebpore.
Datta, G. C.	Tezpur.
Datta, Hira Lal, Asst.-Surgn., L.M.S.	Calcutta.
Datta, Jogendro Nath, M.B.	Calcutta.
Datta, Moni Lal, L.M.S.	Calcutta.
Datta, N. P.	Hoshiarpur.
Datta, Priya Nath, L.M.S.	Dibrugarh.
Datta, R. L., Surgn.-Lt.-Col., I.M.S., M.D., M.R.C.S.	Hooghly.
D'Attaides, F. X.	Myitkina.
Davies, A. M., Surgn.-Major, A.M.S., M.R.C.S., D.P.H.	Meerut.
Deane, A., Surgn.-Lieut.-Col., I.M.S., M.D., F.R.C.S.I.	Srinagar.
Dey, Bir Chandra, M.B.	Rangoon.
Dey, Gopal Chandra, Asst.-Surgn., L.M.S.	Siliguri.
Dey, Grish Chundra, L.M.S.	Calcutta.
Dey, H., Asst.-Surgn., L.M.S.	Saidpur.
Dey, Kanai Lal, Rai Bahadur, C.I.E.	Calcutta.
Dey, M. L., L.R.C.P., M.R.C.S.	Calcutta.
Dey, Roma Nath, Asst.-Surgn., M.B.	Madaripur.
Dey, Rajendra Nath, Asst.-Surgn., L.M.S.	Ghazipur.
Dey, Satish Chandra, Asst.-Surgn., M.A., M.B.	Calcutta.
DeHocat, J. W.	Ceylon.
DeLevera, E.	Ceylon.
Dennys, G. W. P., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Delhi.
Desai, M. G., Asst.-Surgn.	Malegaon.
DeSilva, A., Asst.-Surgn.	Barrackpore.
DeSilva, C. A.	Colombo.
DeSouza, E. M., M.B., C.M.	Rangoon.
Dhur, Bata Krishna, L.M.S.	Calcutta.
Dimmock, H. P., Surgn.-Major., I.M.S., L.R.C.P., M.R.C.S.	Bombay.
Dingra, Sahib Datta, Asst.-Surgn.	Rohtak.
Dixon, M. S., Asst.-Surgn.	Nara (Sind).
D'Monte, D. A., M.D., L.R.C.P., L.R.C.S.	Bandra.
Dobson, A. F., Surgn.-Lieut.-Col., I.M.S., B.A., M.B.	Bangalore.
Dobson, E. F. H., Surgn.-Major, I.M.S., M.B., C.M.	Assam.
Drake-Brockman, H. E., Surgn.-Capt., I.M.S., F.R.C.S.E.	Muttra.
Drake-Brockman, V. G., Surgn.-Lieut., I.M.S., L.R.C.P., M.R.C.S.	Barrackpore.
Drummond, R. J., M.B., C.M.	Ceylon.
Drury, F. J., Surgn.-Capt., I.M.S., B.A., M.B., M.Ch., L.M.	Calcutta.
Duer, C., Surgn.-Capt., I.M.S., M.B., L.R.C.P., M.R.C.S.	Dhubri.
Duke, J., Surgn.-Lieut.-Col., I.M.S., M.R.C.S.	Bhopawar.
Duncan, A., Surgn.-Major, I.M.S., M.D., B.S., F.R.C.S.	Dehra Dun.
Dyal, Bissesur	Kurseong.
Dyson, H. J., Surgn.-Capt., I.M.S., F.R.C.S.	Calcutta

E.

Eliotamby, M.	Point Pedro.
Ernst, Miss A., M.D.	Calcutta.
Evans, J. F., Surgn.-Capt., I.M.S., M.B., C.M.	Calcutta.
Exham, R., Surgn.-Lieut.-Col., A.M.S., L.R.C.P., L.R.C.S.	Simla.

F.

Fairlie, J. D. B.	Colombo.
Fasken, W. A. D., Surgn.-Lt.-Col., I.M.S., M.D., M.R.C.S.	Fatehgarh.
Faulkner, C. L., M.B., C.M.	Darjeeling.
Ferguson, A. F., Surgn.-Major, I.M.S., M.D.	Mhow.
Fermie, A., M.R.C.S., L.R.C.P.	Garo Hills, Assam.
Fernando, H. M., M.D.	Colombo.
Fernando, S.	Colombo.
Fernandez, L., M.D., L.R.C.P., L.R.C.S.E., L.M.	Calcutta.
Ferris, G. R.	Calcutta
Fink, A. J.	Shahpur.
Fink, G. H., Surgn.-Capt., I.M.S., M.R.C.S.	Bijnor.
Forsyth, J., Asst.-Surgn.	Calcutta.
Franklin, B., Bde.-Surgn.-Lieut.-Col., I.M.S., M.R.C.S.	Calcutta.
Fraser, J.	Nowshera.
Frenchman, E. P., Surgn.-Major, I.M.S., L.R.C.P., L.F.P.S., L.M.S.	Bassein.
Freyer, S. F., Surgn.-Capt., A.M.S., M.D., M.Ch.	Umballa.

G.

Gallay, H., Surgn.-Major of the French Colonies.	Pondicherry.
Gangooly, Kadambini, Mrs., L.R.C.P., L.R.C.S.E., L.F.P.S.	Calcutta.
Gangooly, Mohendro Nath, L.M.S.	Cawnpore.
Garvin, J. F.	Colombo

George, Miss E.	Calcutta.
Ghadically, B. P.	Budge-Budge.
Ghosal, Benode Behary, Asst.-Surgn., L.M.S.	Calcutta.
Ghosal, Kali Prosonno, L.M.S.	Calcutta.
Ghosh, Abinash Chandra, Asst.-Surgn., M.B.	Cuttack.
Ghosh, Ashutosh, L.M.S.	Calcutta.
Ghosh, Bepin Behari, M.B.	Calcutta.
Ghosh, Brij Lal, Asst.-Surgn., Rai Bahadoor	Lahore.
Ghosh, Gopal Chundra, Asst.-Surgn., L.M.S.	Calcutta.
Ghosh, Horendra Nath, Asst.-Surgn., L.M.S.	Calcutta.
Ghosh, Jogendra Nath, Asst.-Surgn., L.M.S.	Calcutta.
Ghosh, Kasi Nath, Asst.-Surgn., L.M.S.	Raneegunge.
Ghosh, Mohendra Nath, M.B.	Ranaghat.
Ghosh, N. C., Hospl. Asst.	Midnapore.
Ghosh, Nando Lal, L.M.S.	Calcutta.
Ghosh, Rakhal Das, L.M.S.	Calcutta.
Ghosh, Tarak Nath, Asst.-Surgn.	Shahjahanpur.
Gibbons, J. B., Surgn.-Major, I.M.S., L.R.C.P., L.R.C.S.I.	Calcutta.
Gidney, H., Asst.-Surgn.	Mussoorie.
Gimlette, G. H. D., Surgn.-Major., I.M.S., M.D., M. Ch., M.R.C.S.	Sutna.
Gomes, L. P.	Bombay.
Gonsalves, J. F., Asst.-Surgn.	Bandra.
Gore, A., Surgn.-Col., A.M.S., M.D., L.R.C.P., L.R.C.S.I.	Mhow.
Govind Bhau, Asst.-Surgn.	Kanara District.
Grainger, T., Surgn.-Capt., M.D., M.Ch., M.A.O.	Calcutta.
Gration, E.	Ceylon.
Grayfoot, B. B., Surgn.-Capt., I.M.S., M.R.C.S.	Bombay.
Gregg, W. H., Surgn.-Lieut.-Col., I.M.S., M.D., M.Ch., M.R.C.P., D.P.H.	Calcutta.
Griffiths, G., M.B., C.M.	Assam.
Gupta, B. L.	Howrah.
Gupta, Bepin Behari, Asst.-Surgn., L.M.S.	Dumraon.
Gupta, Chundra Cumar, Asst.-Surgn., L.M.S.	Burdwan.
Gupta, Durga Das, M.B.	Calcutta.
Gupta, K. P., Surgn.-Lieut.-Col., L.M.S., M.A., L.R.C.P., L.R.C.S.	Backergunge.
Gupta, Mohendra Nath, Asst.-Surgn., L.M.S.	Calcutta.
Gupta, Monmohan, Asst.-Surgn., L.M.S.	Calcutta.
Gupta, Nobin Chundra, Asst.-Surgn., L.M.S.	Calcutta.
Gupta, Norendra Nath, Asst.-Surgn., L.M.S.	Noakhali
Gupta, Peary Mohan	Faridpur.
Gupta, Ram Chandra, L.M.S.	Bankipore.
Gupta, Ram Kali, Asst.-Surgn., L.M.S.	Bankipore.
Guranditta Mal, Asst.-Surgn., L.M.	Lahore.

H.

Haldar, Nidu Lal, Asst.-Surgn., L.M.S.	Calcutta.
Haldar, P.	Parbatipur.
Hall, E. A. W., Surgn.-Capt., I.M.S., M.B., C.M.	Purulia.
Hamilton, D. R., Surgn.-Capt., A.M.S., M.B., C.M.	Bareilly.
Hancock, C. J.	Dibrugarh.
Hankin, E. H., M.A.	Agra.
Har Narayan, L.M.	Delhi.
Hare, E. C., Surgn.-Capt., I.M.S., M.R.C.S., L.R.C.P.	Assam.
Harrington, V., Surgn.-Major, I.M.S., L.R.C.P., L.R.C.S.	Bikanir.
Harris, G. A., Surgn.-Major, I.M.S., M.R.C.S., L.R.C.P.	Nagpur.
Harvey, R., Surgn.-Col., I.M.S., M.D., F.R.C.P., D.S.O., LL. D.	Calcutta.
Harwood, J. G., Surgn.-Major, A.M.S., F.R.C.S.E.	Dum-Dum.
Hawkins, F. D. C., Surgn.-Major, I.M.S., M.R.C.S., L.R.C.P.	Etawah.
Hay, Jaganadhan, M.B., C.M.	Khulna.
Hearn, J. F., M.B., B.Ch.	Ranchi.
Hehir, P., Surgn.-Capt., I.M.S., M.D., F.R.C.S.E., D.P.H., F.R.S.E.	Secunderabad.
Henderson, A. E., Miss, M.D., L.R.C.P., L.R.C.S., L.F.P.S.	Nagpur.
Henderson, S. H., Surgn.-Capt., I.M.S., M.B., C.M.	Banda.
Hendley	Jalpaiguri.
Hendley, H., Surgn.-Capt., I.M.S., M.R.C.S., D.P.H.	Peshawar.
Hendley, T. H., Bde.-Surgn.-Lieut.-Col., I.M.S., M.R.C.S., L.R.C.P., C.I.E.	Jeypore.
Hewan, J., L.R.C.P., M.R.C.S.	Jorhat.
Herbert, H., Surgn.-Capt., I.M.S., M.R.C.S., L.R.C.P.	Rajkot.
Hooper, W. R., Bde.-Surgn.-Lieut.-Col., I.M.S., M.R.C.S.	Lucknow.
Hormusjee	Bhopal.
Hudson, H., M.R.C.S., L.R.C.P.	Manargudi.
Huk, E.	Hyderabad (Deccan).
Hulbert, J. G., Surgn.-Lieut., I.M.S., M.A., M.B., B.C., M.R.C.S., L.R.C.P.	Lucknow.
Hunt, S. B., Surgn.-Col., I.M.S., L.R.C.P., L.R.C.S., L.M.	Rangoon.
Hunter, C. B., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Seoni.
Husband, J.	Ajmere.
Hutcheson, G., Bde.-Surgn.-Lieut.-Col., I.M.S., M.D., M.R.C.P., L.R.C.S.	Allahabad.

J.

James, C. H., Surgn.-Capt., I.M.S., L.R.C.P., M.R.C.S.	Ferozepore.
Jameson, G., Surgn.-Capt., I.M.S., M.B., C.M., M.R.C.S.	Rajshahye.
Jameson, J. B., Surgn.-Capt., I.M.S., M.B., C.M.	Jacobabad.
Jenkins, Miss L., L.R.C.P., L.R.C.S., L.F.P.S.	Lucknow.
Jennings, E., Surgn.-Capt., I.M.S., M.R.C.S.	Rungpur.
Jennings, Surgn.-Major, A.M.S., M.D., M.Ch.	Ranikhet.
Joola Prosad, Asst.-Surgn.	Moradabad.
Johnson, O., M.D., M.R.C.S.	Ceylon.
Jones, F. W. C., Surgn.-Capt., A.M.S., M.B., M.R.C.S.	Mhow.
Jones, H. W., L.R.C.P., L.F.P.S., M.R.C.S.	Calcutta.
Jones, J. M., Surgn.-Major, A.M.S., L.R.C.P., L.R.C.S.	Shahjehanpore.
Jordan, J. G., Surgn.-Capt., I.M.S., M.B., C.M.	Barisal.
Joshi, K.	Bhopal.
Joswant Roy	Mozaffarpore.
Joubert, C. H., Surgn.-Lieut.-Col., I.M.S., M.B., F.R.C.S.	Calcutta.

K.

Kaji, Chagan Lal Gulabdas, L.M.S.	Kathiawar.
Kantak, Santoram, Asst.-Surgn., L.M.	Bombay.
Kar, Nogendronath, L.M.S.	Calcutta.

Kar, R. G., L.R.C.P., L.R.C.S.	Calcutta.
Karandikar, Venkatesh Balwant, Asst.-Surgn., L.M.S.	Kanara District.
Karmakar, B. N.	Mymensingh.
Kathawalla, D. E., Asst.-Surgn.	Panch Mahals.
Katrak, Nanabhay Naorosji, L.M.S.	Bombay.
Kaul, B. K., Asst.-Surgn.	Lahore.
Kelly, J., Asst.-Surgn.	Sonthal Pergunnahs.
Kennedy, G. C.	Calcutta.
Ker, M. A., Surgn.-Capt., I.M.S., M.B., C.M.	Simla.
Keyt, F., M.B., C.M.	Ceylon.
Khory, Rastanji Nasservanji, M.D., M.R.C.P.	Bombay.
King, G., Bde.-Surgn.-Lieut.-Col., I.M.S., M.B., F.R.S., C.I.E.	Calcutta.
King, W. G., Surgn.-Lieut.-Col., I.M.S., M.B., C.M., D.P.H.	Madras.
Korb	Hyderabad (Deccan).
Kirtikar, K. R., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Thana.
Kugler, Miss A. S., M.D.	Guntur.
Kumar, Bepin Krishna, L.M.S.	Calcutta.
Kynsey, Hon. W. R., F.R.C.P.I.	Colombo

L.

Laha, Lalit Mohan, Asst.-Surgn., M.B.	Monghyr.
Lahiri, Kali Prasanno, Asst.-Surgn., M.B.	Behar.
Lamont, J. C., Surgn.-Capt., I.M.S., M.B., C.M., M.R.C.S.	Lahore.
Lane, D. T., Surgn.-Capt., I.M.S., M.D., M. Ch., M.A.O.	Chinaivon.
Lane, W. B., Surgn.-Capt., I.M.S., L.R.C.P., M.R.C.S.	Chilas.
Lawrie, E., Surgn.-Lieut.-Col., I.M.S., M.B., M.R.C.S.	Hyderabad(Deccan).
Leahy, A., Surgn.-Major., I.M.S., M.D., F.R.C.S.	Calcutta.
Lemotte, G. H., Surgn.-Major, A.M.S., M.D., M.R.C.S.	Fyzabad.
Leslie, J. W. T., Surgn.-Capt., I.M.S., M.B., C.M.	Simla.
Lethbridge, A. S., Bde.-Surgn.-Lieut.-Col., I.M.S., M.D., M.R.C.S., C.S.I.	Calcutta.
Lewtas, J., Surgn.-Major, I.M.S., M.D., M.R.C.S.	Simla.
Love, R. L., Surgn.-Major, A.M.S., B.A., M.D., M.Ch., M.R.C.P.I.	Darjeeling.
Lowdell, C. G. W., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Nasik.
Lumsden, J. S., Surgn.-Capt., I.M.S., M.B., C.M.	Bannu.

M.

Macdonald, D. P., Surgn.-Lieut.-Col., I.M.S., M.D., M.Ch., L.R.C.P.I.	Port Blair.
Macdonald, D. P., Surgn.-Lieut.-Col., M.D.	Ceylon.
Macdowell, K.	Benares.
Mackenzie, D.	Calcutta.
Mackenzie, E.	Manora.
Macnamara, J. W., Surgn.-Major, I.M.S., M.D., L.R.C.S.I., L.M.	Tezpur.
Macnamara, R. J., Surgn.-Capt., I.M.S., M.D., M.Ch.	Mooltan.
MacNicol, M., M.B., C.M.	Hooghly.
Macphail, J. M., M.B., C.M.	Chakai.
Macrae, J., Surgn.-Major, I.M.S., M.B., C.M.	Gaya.
Macrobin, A. A., Surgn.-Lieut.-Col., A.M.S., M.B., C.M.	Bareilly.
Madak, Kedar Nath, Asst.-Surgn., L.M.S.	Tangail.
Mahomed, Abbas, Asst.-Surgn.	Hyderabad(Deccan).
Mahomed, Ismail Jan	Bombay.
Mahomed, Abdul Rahim, Asst.-Surgn., L.M.	Lucknow.
Maitland, J., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Madras.
Maitra, Rash Behary, Asst.-Surgn., L.M.S.	Beawar.
Mansel, Mrs. M.	Mussoorie.
Martin, Miss M.	Calcutta.
Martin, W. T., Surgn.-Col., A.M.S., M.A., M.D., L.R.C.S.I.	Lucknow.
Massina, Hormasji Maneckjee, L.M.S.	Bombay.
Massy, G., Bde.-Surgn.-Lieut.-Col., I.M.S., L.R.C.P.I., L.M., M.R.C.S.	Murree.
Mattox, F. W.	Calcutta.
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Maynard, F. P., Surgn.-Capt., I.M.S., M.B., L.R.C.P., M.R.C.S., D.P.H.	Calcutta.
Mayne, T., Surgn.-Lieut.-Col., M.R.C.S.	Bangalore.
McKay, H. K., Surgn.-Lieut.-Col., I.M.S., M.R.C.S.	Jubbulpore.
McConnell, J. F. P., Surgn.-Lieut.-Col., I.M.S., M.D., F.R.C.P.	Calcutta.
McLeod, H. A.	Korantadeh.
McLeod, J. N., Surgn.-Lieut., I.M.S., M.A., M.B., C.M.	Calcutta.
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Meadows, C. J. W., Surgn.-Lieut.-Col., I.M.S., M.R.C.S.	Burdwan.
Mehr Chand, Rai Bahadoor	Amritsur.
Mehta, Dhonjibhai, L.M.S.	Kathiawar.
Mehta, Duni Chand, Asst.-Surgn.	Sialkot.
Melville, C. H., Surgn.-Capt., A.M.S., M.B., C.M.	Nasirabad.
Melville, H. B., Surgn.-Capt., I.M.S., M.B., C.M.	Azamgarh.
Mirza, Ahmed	Hyderabad(Deccan).
Mirza, Karim Khan	Hyderabad(Deccan).
Mirza, Mahomed Massoom	Calcutta.
Mistri, K. H., Surgn.-Major, I.M.S., L.R.C.S.E.	Godhra.
Mitra, A., Rai Bahadur, L.R.C.P., L.R.C.S.	Kashmir
Mitra, A. C., Asst.-Surgn.	Lucknow.
Mitra, Annoda Prasad	Alipore.
Mitra, B.	Midnapore.
Mitra, B. M., Asst.-Surgn.	Calcutta.
Mitra, Ganga Narain	Burdwan.
Mitra, Jagabandhu, L.M.S.	Burdwan.
Mitra, Mohindro Lal, Asst.-Surgn., L.M.S.	Calcutta.
Mitra, Moti Lal, M.B.	Mozufferpore.
Mitra, N.	Calcutta.
Mitra, Naresh Chandra, M.A., M.B.	Ranchi.
Mitra, Ram Chandra, Asst.-Surgn., L.M.S.	Calcutta.
Mitra, U. C.	Dibrugarh.
Mitra, Upendra Nath, M.B.	Calcutta.
Mody, Ardeshwar Dadabhai, L.M.S.	Bombay.
Moffit, T. B., Surgn.-Major, A.M.S., L.R.C.P., L.R.C.S.I., L.M.	Barrackpore.
Moir, D. M., Surgn.-Capt., I.M.S., M.A., M.B., C.M.	Calcutta.
Mondal, A. L.	Jalpaiguri.

Monilall, Asst.-Surgn	Rai Bareli.
Mookerjee, Aghore Nath, L.M.S.	Alipore.
Mookerjee, Annoda Prosad, L.M.S.	Burdwan.
Mookerjee, Gopal Chandra, Asst.-Surgn., B.A., M.B.	Katihaor, Purneah.
Mookerjee, Hem Chandra, L.M.S.	Calcutta.
Mookerjee, Jageshwar, Asst.-Surgn., M.B.	Calcutta.
Mookerjee, Lall Madhub, Rai Bahadur, L.M.S.	Calcutta.
Mookerjee, Motilall, Asst.-Surgn., L.M.S.	Cossipore.
Mookerjee, Nripendra Chandra, Asst.-Surgn., L.M.S.	Fatehpur.
Mookerjee, Nritya Charan, M.B.	Calcutta.
Mookerjee Promatha Nath, L.M.S.	Calcutta.
Mookerjee, S., M.D., Ph.D., D.P.H.	Calcutta.
Mookerjee, Soshi Bhuson, Asst.-Surgn,, L.M.S.	Chanchal.
Mookerjee, S. C.	Midnapore.
Mookerjee, S. K.	Roorkee.
Mookerjee, Surendra Nath, L.M.S.	Calcutta.
Mookerjee, T. N.	Calcutta.
Mookerjee, Umesh Chandra, M.B.	Bankura.
Moore, C. M., Surgn.-Capt., I.M.S., M.D., M.A.O.	Western Malwa.
Moore, T. C., Surgn.-Capt., I.M.S., L.R.C.P., L.R.C.S.I., C.M.	Belgaum.
Moorhead, J., Surgn.-Major, I.M.S., M.D., M.R.C.S.	Simla.
Moos, F. A., Asst.-Surgn.	Thana.
Morphew, E. M., Surgn.-Capt., A.M.S., M.R.C.S., L.R.C.P.	Calcutta.
Morrison, D.	Rampur Beauleah.
Morton, J., M.D., L.R.C.P., L.R.C.S., L.F.P.S.	Mussoorie.
Morwood, J., Surgn.-Captn., I.M.S., M.D., M.Ch.	Shahjahanpore.
Mouat, F. J., M.D., F.R.C.S., LL.D.	London.
Moses, S. O., L.R.C.P., L.F.P.S.	Calcutta.
Mozumdar, Annada Prosad, Asst.-Surgn., L.M.S.	Calcutta.
Mozumdar, Troylokhonath, L.M.S.	Bankipore.
Mudaliar, C. S.	Madras.
Mull Raj, Asst.-Surgn.	Fyzabad.
Mullen, D. Ffrench, Surgn.-Major, I.M.S., M.D., M.Ch.	Ajmere.
Mullen, T. Ffrench, Bde.-Surgn.-Lieut.-Col., M.D., M.Ch.	Jodhpore.
Mullick, Kunja Lal, L.M.S.	Calcutta.
Murphy, W., Surgn.-Lieut.-Col., I.M.S., L.R.C.P., L.R.C.S. & L.M., D.S.O.	Dehra Dun.
Murray, R. D., Surgn.-Major, I.M.S., M.B., C.M.	Chittagong.
Murray, W. F., Surgn.-Col., M.B., M.Ch.	Arrah.

N.

Nabi Baksh	Nagpore, C. P.
Naidu, M. G.	Hyderabad.
Naidu, V. V., Asst.-Surgn.	Madras.
Narsingha Rao, L.M.S.	Bellary.
Narayan, Kumar Bhupendra	Pubna.
Nariman, K. S., Surgn.-Major, I.M.S., L.R.C.S.E.	Surat.
Nariman, Pestonji Bhikhaji, L.M.S.	Zanzibar.
Nariman, Temulji Bhikhaji, L.M.	Bombay.
Nathu Mal, Asst. Surgn.	Patiala.
Newgy, Surendra Nath, Asst.-Surgn., M.B.	Sewan.
Nicholl	Assam.
Nicholas, Miss E. L.	Berhampore.
Nicholson, F. C., Bde.-Surgn.-Lt.-Col., I.M.S., M.D.	Bankipore.
Nicholson, J. P.	Bombay.
Nicholson, M.	Nahan.
Nolan, A. H., Asst.-Surgn.	Monywa.
Norvill, F. H., M.B., M.R.C.S.	Doom Dooma.
Nott, A. H., Surgn.-Captn., I.M.S., M.B., L.R.C.P., M.R.C.S.	Hazaribagh.
Nundy, Kunja Behary, Asst.-Surgn., L.M.S.	Calcutta.
Nundy, Purna Chandra, M.B.	Calcutta.
Nundy, Priyo Nath	Calcutta.

O.

O'Brien J., Surgn.-Lieut.-Col., I.M.S., M.A., M.D., F.R.C.S.E.	Calcutta.
O'Conor, W.	Delhi.
O'Gorman, P. W., Surgn.-Capt., I.M.S., L.R.C.P., L.R.C.S., L.F.P.S.	Midnapore.
Ohdedar, M. N., Rai Bahadur, Asst.-Surgn., L.M.S., V.H.S.	Allahabad.
OKinealy, F., Surgn.-Capt., I.M.S., L.R.C.P., M.R.C.S.	Calcutta.
Oldham, B. C., Surgn.-Capt., I.M.S., L.R.C.P., M.R.C.S.	Calcutta.
O'Neil, G. S., Asst.-Surgn.	Calcutta.
Oorloff, F.	Ceylon.
Owen, C. W., Surgn.-Major, I.M.S., M.R.C.S., L.R.C.P., C.I.E.	Patiala.
Owen, Miss	Bankipore.
Owen, W., Surgn.-Major, I.M.S., B.A., M.B., L.R.C.S.I., L.M.	Bankipore.

P.

Pal, Bhola Nath, Asst.-Surgn., L.M.S.	Samastipur.
Pal, N. C.	Calcutta.
Pal, Sital Chundra, L.M.S.	Narail.
Palit, Mrs. Sarola Sundari	Allahabad.
Palpu, P., Asst.-Surgn.	Madras.
Panday, R. C.	Assam.
Panioty, J., L.R.C.P., L.R.C.S.	Calcutta.
Pank, P. D., Surgn.-Major, I.M.S., L.R.C.P., L.R.C.S.	Oodeypore.
Pant, H. D., Asst.-Surgn.	Almora.
Parakh, N. N., L.F.P.S.	Rangoon.
Parkinson, J. T., Asst.-Surgn.	Calcutta.
Peck, F. S., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Mozufferpore.
Pedlar, H.	Calcutta.
Pedley, T. F., M.D., M.R.C.S., L.D.S., L.S.A.	Rangoon.
Pereira, S. B.	Ceylon.
Phailbus, Miss R. M.	Krishnaghur.
Phillips, J. L.	Calcutta.
Picachy, D., M.R.C.S.	Purneah.
Pilgrim, H. W., Surgn.-Capt., I.M.S., M.B., M.R.C.S.	Calcutta.
Pisani, L. J., Surgn.-Capt., I.M.S., M.R.C.S.	Jaunpur.
Pocha, J. P., L.M.S.	Bombay.
Pogose, G.	Calcutta.
Ponder, C., M.B., C.M.	Kalimpong.
Poole, W. C., Surgn.-Capt., A.M.S., B.A., M.D., F.R.C.S.I., L.M.	Calcutta.
Pope, T. H., Surgn.-Major, I.M.S., M.D.	Madras.
Powell, A., B.A., M.Ch.	Cachar.

Poynder, J. L., Surgn.-Major, I.M.S., L.R.C.P., M.R.C.S.	Sambalpur.
Prabhakar Gobindrao Bhau, L.M.S.	Bombay.
Pratt, J. J., Surgn.-Capt., I.M.S., L.R.C.P., C.S., L.M.	Gonda.
Price, G., Surgn.-Lieut.-Col., I.M.S., M.D., M.Ch., L.M.	Berhampore.
Purdon, J., L.R.C.P., L.R.C.S.I., L.M.	Cachar.
Purves, H. B., Bde.-Surgn.-Lieut.-Col., I.M.S., L.R.C.S.E.	Howrah.

Q.

Quayle, W. A., Surgn.-Major, I.M.S., M.D., M.CH., L.M.	Khandwa.
Quicke, W. H., Surgn.-Capt., I.M.S., M.D., M.R.C.S.	Bombay.

R.

Rahim Khan, Asst.-Surgn.	Lahore.
Rai, Kali Nath, Asst.-Surgn.	Rawal Pindi.
Rai, Shastirar, Asst.-Surgn.	Lucknow.
Rajasinghan, A.	Ceylon.
Ram Kishen, Asst.-Surgn.	Amritsar.
Ram Narayan, Asst.-Surgn., L.M.	Delhi.
Rama Rao, C. B., L.M.S.	Madras.
Ramsbottom, Miss A.	Darbhanga.
Ram Chandra, D.	Nagpur, C. P.
Ranger, G. O., L.D., S.R.C.S.I.	Calcutta.
Ranking, Surgn.-Maj., I.M.S., B.A., M.D., M.R.C.S.	Calcutta.
Rao, T. S.	Hyderabad (Deccan).
Rice, W. R., Surgn.-Major-Genl., I.M.S., M.D., M.R.C.S., C.S.I.	Simla.
Rigby, P. A., L.S.A.	Calcutta.
Roberts, A. E., Surgn.-Capt., I.M.S., M.B., C.M., M.R.C.S.	Aligarh.
Roe, C., Bde.-Surgn.-Lieut.-Col., L.R.C.S.I.	Calcutta.
Roe, W. A. C., Surgn.-Lieut.-Col., I.M.S., F.R.C.S.E., D.P.H.	Lahore.
Rogers, L., Surgn.-Lieut., I.M.S., M.B., B.S., F.R.C.S.	Allahabad.
Rogers, R. T.	Peshawar.
Rowley, J., Asst.-Surgn.	Kanchrapara.
Roy, A. C.	Tezpur
Roy, A. C.	Calcutta.
Roy, C. K.	Rampore Hât.
Roy, Debendra Nath, Asst.-Surgn., L.M.S.	Calcutta.
Roy, Kherode Chandra, Asst.-Surgn., L.M.S.	Oolooberia.
Roy, Rammoy, L.M.S.	Bhowanipur.
Roy, Rajendra Nath	Dacca.
Roy, S. C.	Calcutta.
Roy, Siba Prosad, M.B.	Allahabad.
Roy, Uma Charan, Asst.-Surg., L.M.S.	Calcutta.
Roy, Upendra Narayan, Asst.-Surgn., M.B.	Chupra.
Rudd, W. E., M.R.C.S.	Ceylon.
Rudolf, N.	Saran, Chupra.
Rundle, C.S., Surgn.-Major, I.M.S., M.B., C.M.	Thayetmyo.
Russell, E. G., Surgn.-Lieut.-Col., I.M.S., M.B., B.S.C., M.R.C.S.	Dacca.

S.

Salamon, S. M., Bde.-Surgn.-Lieut.-Col., I.M.S., M.D., M.R.C.S.	Poona.
Sandilands, J., M.B., C.M.	Bhandara.
Sandwith, F. M., M.D., M.R.C.P., M.R.C.S.	Cairo.
Sanyal, Deno Nath, Asst.-Surgn., B.A., M.B.	Jessore.
Sanyal, Hem Chandra, L.M.S.	Delhi.
Sanyal, Kunjo Lal, Asst.-Surgn., L.M.S.	Dacca.
Sanyal, Poolin Chandra, M.B.	Dumkah.
Sarbadhicari, Surjee Coomar, G.M.C.B.	Calcutta.
Sarbadhicari, Suresh Prosad, B.A., M.D.	Calcutta.
Sarin, Ranjit Singh, Asst.-Surgn.	Sitapur.
Scott, J., Surgn.-Major, I.M.S.	Secunderabad.
Seal, C. E., M.R.C.S., L.R.C.P.	Sylhet.
Seal, Kanai Lall, B.A., M.B.	Calcutta.
Selke, D. M., Asst.-Surgn.	Poona.
Sen, Abhoy Coomar, Asst.-Surgn., L.M.S.	Tumluk.
Sen, Balye Chandra, Asst.-Surgn., L.M.S.	Calcutta.
Sen, Bamon Das, L.M.S.	Calcutta.
Sen, Bhanga Chandra	Assam.
Sen, Guru Nath, Asst.-Surgn., L.M.S.	Utterparah.
Sen, Hari Charan, Asst.-Surgn., L.M.S.	Kishengunge.
Sen, Hem Chundra, Asst.-Surgn., M.B.	Calcutta.
Sen, Hem Chandra, L.M.S.	Delhi.
Sen, Jadab Krishna, Asst.-Surgn., L.M.S.	Contai.
Sen, Kali Prasanno	Darjeeling.
Sen, Lalit Mohan, Asst.-Surgn.	Orai.
Sen, Mohendra, Nath, L.M.S.	Calcutta.
Sen, Nogendra Nath	Calcutta.
Sen, P. C.	Dinagepore.
Sen, R., L.F.P.S.G.	Calcutta.
Sen, Sama Charan, L.M.S.	Mozufferpore.
Sen, Surendra Nath, L.M.S.	Calcutta.
Sen, Upendra Nath, Asst.-Surgn, L.M.S.	Maldah.
Sethna, Merjeebhai, R.	Bombay.
Shaha, Brojo Nath, Asst.-Surgn., L.M.S.	Rangamati.
Shah, Chetan, Asst.-Surgn.	Ludhiana.
Shah, T., Asst.-Surgn., L.M.	Kathiawar.
Shaik Mahomed Hossain	Barh (Patna).
Sidney, H., Asst.-Surgn.	Mussoorie.
Silcock, A., Surgn.-Major, I.M.S., B.A., M.D., M.R.C.P.I., L.M., D.P.H.	Bilaspur.
Simmons, W. J.	Calcutta.
Simpson, E. J., L.R.C.P., L.F.P.S.	Rai Bareli.
Simpson, W. J., M.D., M.R.C.P., D.P.H.	Calcutta.
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Sinclair, G.	Kholapur.
Singh, Soshi Bhusan, Asst.-Surgn., L.M.S.	Mozufferpore.
Singh, Surjee Narain, Asst.-Surgn.	Bankipore.
Sinha, N. P., Surgn.-Capt., I.M.S., M.R.C.P., M.R.C.S.	Jessore.
Sircar, Bhuban Mohan, L.M.S.	Calcutta.
Sircar, K. G., M.B., L.R.C.P., L.F.P.S.G.	Calcutta.
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